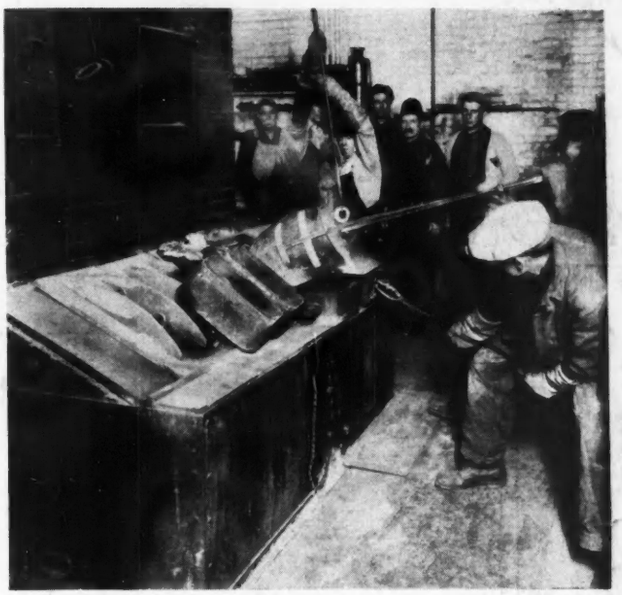
SCIENCE LIBRARY

A McGRAW-HILL PUBLICATION

JAN 27 1930

Engineering and Mining Journal



Pouring gold at the Homestake plant, Lead, South Dakota

January 23
1930

Cyanite in North Carolina

A. F. GREAVES-WALKER

Tax Relief for the Prospector

GRANVILLE S. BORDEN

Air Separation of Non-Metallic Minerals

RUBERT M. GAY

Rope Tramways With Angle Towers and Stations

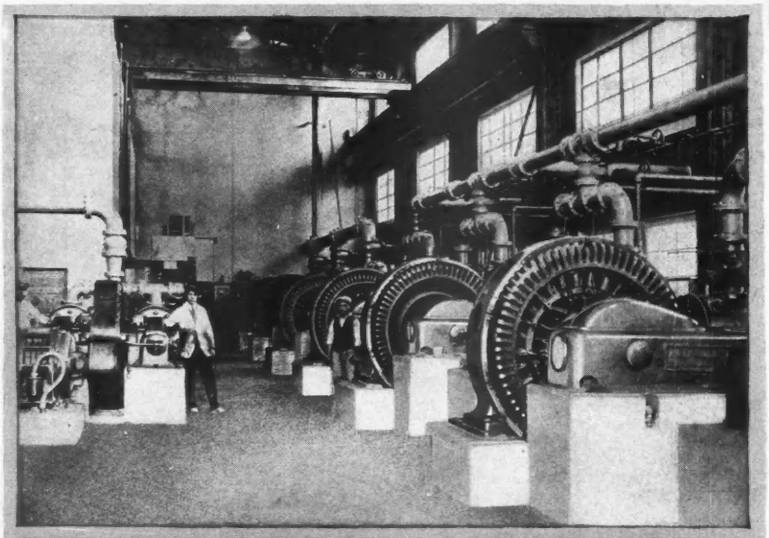
FRED C. CARSTARPHEN

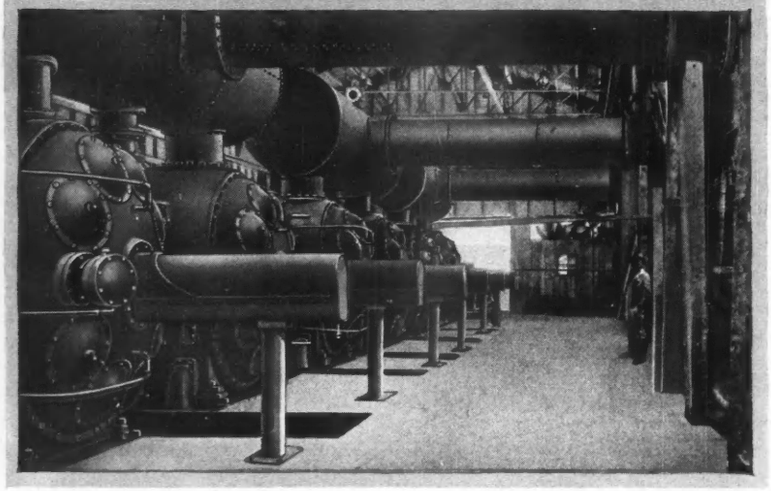
Metallurgical Equipment at New Nichols Refinery

EDWARD H. ROBIE

◀ THE NEXT ISSUE WILL BE THE
◀ SIXTY-FIRST ANNUAL
◀ REVIEW NUMBER

South of the Equator—





THE Ingersoll-Rand compressors shown at the left are installed in the refinery of a large copper company in South America. The aggregate piston displacement of the eight I-R machines is more than 53,000 cu. ft. per minute. All these units are direct connected to synchronous motors. The three Class PRE-I compressors in the lower view have duplex cylinders, each of 48-inch diameter and 36-inch stroke.

The dependability of Ingersoll-Rand compressors is well known wherever metal is produced.

INGERSOLL-RAND COMPANY
11 Broadway - New York City
Branches or distributors in principal cities the world over
For Canada refer: Canadian Ingersoll-Rand Co., Ltd.
10 Phillips Square, Montreal, Quebec

983-C

Ingersoll-Rand

R-2011

ENGINEERING AND MINING JOURNAL. Jan. 23, 1930. Vol. 129, No. 2. Published semi-monthly. Price in the United States and possessions, 25 cents (U. S. currency) per copy; $4 per year. In all other countries, $8 per year—24 issues. Entered as second-class matter, June 20, 1879, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

ENGINEERING AND
MINING JOURNAL
A McGRAW-HILL PUBLICATION

A. W. ALLEN, *Editor*

Associate Editors
E. H. ROBIE, A. H. HUBBELL
New York
GEORGE J. YOUNG, San Francisco

Assistant Editors
W. N. P. REED, H. D. KEISER
S. D. STRAUSS
Market Editor: H. H. WANDERS
Publishing Director: H. W. CLARKE

Contents for January 23, 1930

Contents Copyrighted, 1930, by McGraw-Hill Publishing Company, Inc.

VOLUME 129 . . . NUMBER 2

Editorials 55

Stimulating the Demand for Silver . . . . Future of the Pacific Coast Iron and Steel Industry . . . . Automatic Control of Pumping Underground . . . . Waiting for the Consumer to Buy . . . . The Engineer Must Develop Personal Salesmanship . . . . The Changing Concept of Research . . . . Plant and Shops Require Adequate Heating . . . . Curtailment, Unemployment, and the Five-Day Week

Improving on Rope-Tramway Location 59
FRED C. CARSTARPHEN

Diversified Mining 63
WILLIAM CROOKS

Air Separation Effective in the Non-Metallic Mineral Industries 65
RUBERT M. GAY

Tax Relief for the Prospector 69
GRANVILLE S. BORDEN

A Remarkable Rescue 71
ARNOLD GUSTAFSON

Furnace and Casting Equipment of the New Nichols Refinery 73
EDWARD H. ROBIE

Domestic Chrome Mining 77
W. P. LASS

Roasting With Sulphuric Acid Increases Zinc Recovery 79
B. H. STROM

Sixty Years Ago 80

Plant Lighting 81
A. H. HUBBELL

Sulphur Mining 83
G. G. HOLLINS

Sintering Machine Igniter 87
A. F. BEASLEY

Effect of Heat in Cyaniding and Flotation 62
Needless Waste of Metals Said to Occur in Smelting Tri-State Ores 64
Mohave Desert Region 68
Placing a Soft-Rubber Gasket .. 68
Geology and Science 72
Safety Guard for Cold Chisel .. 78
Status of Mineral-bearing Public Lands 82
A Forerunner of the Modern Ball Mill 85
Personal Notes 86
Comment and Criticism 88
Industrial Progress 89
Mining News 92
Cables 99
Market and Financial News ...100
Metal Price Curves 107
Mining Stocks 108
Searchlight Section 54
Advertising Index 60

The February 8 Number will contain the Annual International Review of the Mining Industries

McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., New York, N. Y.

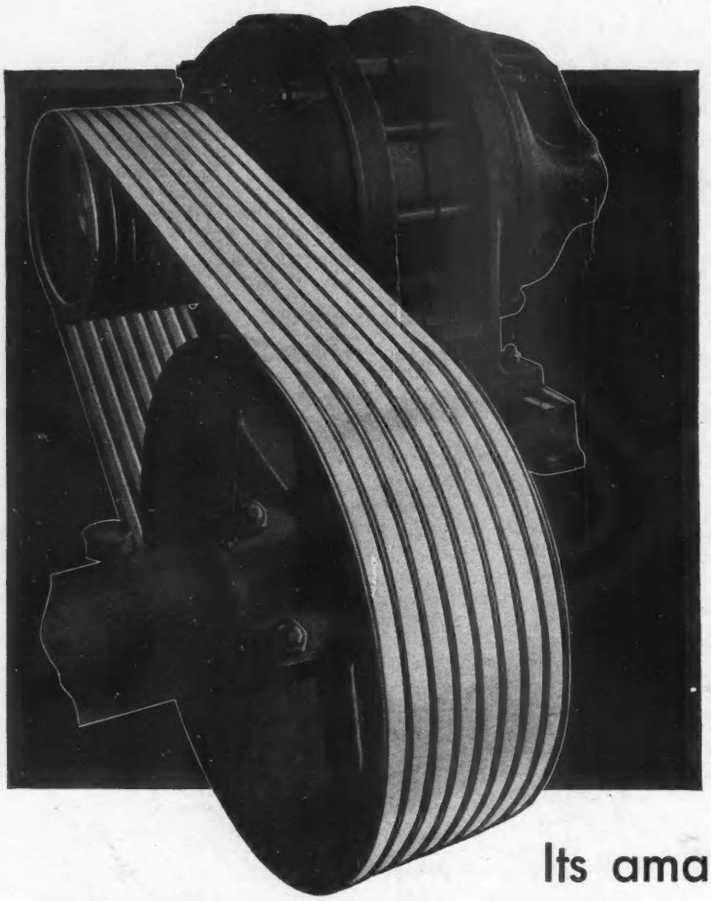
JAMES H. McGRAW, Chairman of the Board
MALCOLM MUIR, President
JAMES H. McGRAW, JR., Vice-Pres. and Treas.
EDWARD J. MEHREN, Vice-President
MASON BRITTON, Vice-President
EDGAR KOBAK, Vice-President
HAROLD W. McGRAW, Vice-President
H. C. PARMELEE, Editorial Director
C. H. THOMPSON, Secretary

CABLE ADDRESS: "MACHINIST, N. Y."

Member A.B.P. *Member A.B.C.*

7,937 COPIES PRINTED THIS ISSUE

NEW YORK District Office, 285 Madison Ave.
WASHINGTON, National Press Building
CHICAGO, 520 N. Michigan Ave.
PHILADELPHIA, 1600 Arch Street
CLEVELAND, Guardian Building
ST. LOUIS, Bell Telephone Building
SAN FRANCISCO, 883 Mission Street
LOS ANGELES, 632 Chamber of Commerce Bldg
BOSTON, 1427 Statler Bldg.
GREENVILLE, S. C., 1301 Woodside Bldg.
DETROIT, 2-257 General Motors Bldg.
LONDON, 6 Bouverie St., London, E. C. 4



Texrope Belts and Sheaves are carried in stock at points from which the entire country can be served promptly. Standard drives from 2 to 100 H. P. are thus available. Quick delivery can be made on larger drives.

Over 70,000 in service

Its amazingly rapid acceptance is the most Convincing Recommendation for Texrope

APPROXIMATELY four years ago Texrope Drive was announced to industry.

Today over 70,000 Texrope Drives are in service . . . giving more satisfactory performance than any other method of transmission . . . In every industry the trend is definitely toward Texrope.

In plants where flat belts last only a few weeks, Texropes are giving continuous service. Replacements are infrequent and inexpensive.

Where moisture or dirt is unavoidable, Texrope Drives operate with no loss in efficiency. Requiring no lubrication, the maintenance cost on Texropes is practically nothing . . and the drive is always clean, positive and silent.

From the fractional horsepower drives to heavy duty on crushers, mining machinery, oil line pumps and paper machinery, Texrope Drives are giving continuous service at amazingly low cost.

See How Texrope Solves Transmission Problems

Texrope Drive consists of a driving and a driven sheave, grooved for V-shaped endless Texrope belts of rubberized cord fabric. Power is transmitted, with no slippage, by the wedging contact of the belts in the V-shaped grooves. The result is a short center drive with an efficiency of 98.9 per cent, requiring practically no maintenance and infrequent adjustment.

Continuous operation is assured. One or two belts may wear out after long service, but the remaining belts will carry the load until replacement is convenient. With Texrope it is possible to use a higher speed motor, with a consequent saving in cost . . . Texrope is rightly termed "The Perfect Transmission for Every Purpose". It will save money for you. Send for a copy of Bulletin 1228-K.

ALLIS-CHALMERS MANUFACTURING CO., (*Texrope Division*) Milwaukee, Wis.

Builders of Power Machinery Since 1846

ALLIS-CHALMERS

TEXROPE DRIVES

THE PERFECT TRANSMISSION — **FOR EVERY PURPOSE ••**

ENGINEERING AND
MINING
JOURNAL

A. W. ALLEN, *Editor*

VOLUME 129, NUMBER 2

A McGRAW-HILL PUBLICATION

ESTABLISHED 1866

New York, January 23, 1930

Stimulating the Demand for Silver

SILVER is in the doldrums. Price recently touched a new low level, and the outlook for an early recovery is not promising. Production is not so easily controllable as is that of the other non-ferrous metals. Excess of supply over demand, a present actuality, will develop into a still greater menace in the future—if nothing is done.

A decade or less ago the price of brass and bronze ornaments, of utensils and knickknacks, bore no relation to the cost of the metals used in their manufacture. Since then the producer has taken an interest in merchandising to the final consumer. The popularization of the non-ferrous base metals has resulted in a general decline in the cost of all such brass or bronze goods, which can now be obtained at an expense that is not in outrageous proportion to the cost of the metals themselves. Unquestionably, the consumption of brass and bronze has been increased thereby. Because of the comparatively small tonnage of metals involved, however, the appreciation has had little effect on the market situation. But with a precious metal the result would be different.

Only a few years ago the pocket book of the householder who requisitioned guttering, spouting, piping, or hardware of a non-rustable metal was considered vulnerable to unreasonable gouging by those handling such material in the manufactured condition. In recent years a significant change has occurred. The producers have realized the futility of merely producing, of allowing those who are not interested in increased metal consumption to control the situation, seriously imperiling the demand by a shortsighted policy of high prices to the ultimate consumer. The result has been a marked stimulation of consumption and a diminution in sales resistance. Much remains to be done, however. An absurd and arbitrary selling cost, based on the initial value of the component parts of the article, is assumed and accepted as logical. This increment, providing an abnormal return to the merchandiser in many instances, is a drag on the increased consumption of non-ferrous metals. The ratio appears to be fixed, irrespective of public demand or personal preference. To sell a copper washing machine apparently costs as much now as was the case when the price differential in favor of iron constituted a serious obstacle to success. Nevertheless, thanks to research, persistence, co-operation, and a spirit of optimism, the copper and brass industries are in a sound economic position today.

The silver producer must tread the same path or pass out of the picture. He must pay serious attention to the problem of increasing consumption. The fact that a government department obtained no favorable result in an attempt to evolve a non-tarnishable silver alloy should not be allowed to exert a permanently adverse psychological effect. He would be a bold man to predict finality in such an investigation. Unfortunately, however, the publicity given to the study served merely to deflect attention from the fact that one potential outlet for silver still persists, despite the tarnishability of the metal.

Sterling silverware is not used to the extent indicated by a common-sense survey. A demand is not being met because of the prohibitive cost to the consumer, a cost that is out of all proportion to the cost of the metal. The changing of patterns, involving the remelting and re-fashioning of the metal to meet an assumed demand for "style" (which in reality exists only among a small minority), together with the expense of pressure-selling, are responsible for the high ultimate cost to the consumer. The fate of an important outlet for silver is unduly influenced by craftsmen and jewelers, who are mainly interested in stimulating the employment of men rather than in promoting an increased consumption of a basic material.

Householders and gift givers in large numbers would purchase sterling silverware if the prices were reasonable—if the cost bore some logical relation to the market price of the metal. One suggested solution of the problem is for a few of the more progressive silver producers to follow their product through to the ultimate consumer—to apply engineering common sense to the economic problems of manufacture and distribution to Mr. Average Citizen. Research, careful planning, a necessary investment in fabricating facilities, and judicious advertising might thus bring a small but welcome profit to such a subsidiary enterprise, prevent the further demoralization of an important mining industry, and stimulate a confidence in the future of silver that is sadly lacking at present.

Recent conversations with some of the more prominent directors of industrial research in the United States have shown that the producers of silver have been backward in not utilizing the facilities for fact finding and discovery that are available. One prominent national institution has a long waiting list, but the silver industry is

apparently unbelieving, or indifferent to the influence of an important trend of the times. Those in close touch with the food industries aver that silver might play a much more important part than it does in the construction and maintenance of processing equipment. Little is known of the silver-aluminum alloys, which might be used for many useful and ornamental purposes. No effort seems to have been made to stimulate the demand for sterling-silver articles in the "5 and 10" class—to benefit from an immense number of sales of very small individual amounts of the metal.

Research is needed on all phases of silver production, utilization, fabrication, merchandising, and consumption, to determine and co-ordinate the physical and chemical properties of silver, to classify the knowledge gained, and to use it as a foundation for constructive suggestion. This work should not be delayed until all the producers are of one mind—until conditions have become so acute that funds are no longer available. Many other industries have been rejuvenated by the splendid initiative of one producer only. A case in point is illustrated by the recent history of borax, the consumption of which in the fine-glass industry has been enormously stimulated by research and action on the part of the American Potash & Chemical Corporation, controlled by the Gold Fields American Development Company. A far greater opportunity for initiative and action would appear to be open for a broad survey of the prospects for increasing the consumption of silver in industry and in the home.

Future of the Pacific Coast Iron and Steel Industry

THE PURCHASE of the plants of the Columbia Steel Corporation by the United States Steel Corporation marks the first decisive step of any major steel company in acquiring manufacturing facilities in the Pacific Coast region. In a marketing sense, some of the larger companies have had representatives in the Pacific Coast region for many years. Other interests have made intensive studies of the facilities for the establishment of an iron and steel industry in the West, but plans have not materialized.

Two companies, Columbia Steel and Pacific Coast Steel, both local ventures, are the principal manufacturers in the region. By a careful study of near-by markets they were enabled to develop products that found a ready sale, so business grew. In the specialty field, a branch of the American Manganese Steel Company established itself on a firm basis and is now extending its marketing area. Still smaller establishments, such as those engaged in the manufacture of hard-surfacing alloys, found in the requirements of the petroleum companies a profitable outlet for their products.

The advent of United States Steel in the Pacific Coast region, as a manufacturer as well as a purveyor of basic iron and steel products, must mean an acceleration in the expansion of this activity. Whether or not it will mean an increase in the facilities for the manufacture of pig iron remains to be seen, but one hopes that it will. Additional mining of iron ore will be helpful. It will make more valuable those deposits now accessible to transportation.

Automatic Control of Pumping Underground

THE practice of controlling mine pumping automatically is gaining ground in the metal-mining industry. One of the largest operators in the United States has recently elected to adopt it. That the trend to automatic control has not been more rapid is surprising. Metal-mine operators might well take a leaf out of the book of their brethren in the coal industry, for the leading coal companies in the anthracite region and a growing number in the bituminous field seldom install a pump which is not equipped to operate automatically.

Automatic pumping saves wages that would otherwise be paid to an attendant. It safeguards pump and motor far better than the most intelligent attendant could possibly do. Operation of the pumps during fixed hours is possible with never-failing regularity. It guarantees that the pump runs always most efficiently. Common practice with manually operated pumps is to reduce the capacity by throttling the discharge during the dry season, so that the pump can run continuously. Frequent starting and stopping is too bothersome for the attendant. Throttling, however, wastes power.

Intelligent daily inspection of pump and motor, moreover, has been found better than the continuous tinkering with the equipment by a pump runner. A 2,200-g.p.m., 440-ft. head pump at the Heidelberg Colliery of the Lehigh Valley Coal Company has been operating without an attendant since 1926. It ran 16,025 hours in these four years before repairs or replacement (except packing) became necessary. Within that period the pump made about 10,000 starts, and no trouble was experienced with the electrical equipment.

Some motor-driven plunger pumps in good condition have been replaced by automatically operated centrifugal pumps, despite the fact that plunger pumps show on the average 10 per cent better efficiency. However, the saving in power is usually much less than the saving in wages. In addition, a considerable saving in maintenance cost is effected.

Waiting for the Consumer to Buy

STOCKS of blister and refined copper increased a little over fifty thousand tons last month. For this accumulation the psychology of the ultimate consumer must be held responsible. Buying of copper products has dropped away so drastically in the last two or three months that fabricators have curtailed operations to such an extent that the copper bought for requirements up to the end of November is lasting to the end of January. And, if the sale of copper products does not increase soon, shipments for February consumption will not be likely to cut much of a hole into stocks, even with a further curtailment of mine production.

This is not because the ultimate consumer has no money. The excellent holiday business of the department stores—two per cent better than last year in the

New York area—proves that. Holiday gift-buying could not be postponed much beyond Christmas eve; but the average citizen, with money in the bank, feels that nothing is likely to be lost and something may well be gained by postponing those purchases not demanded by immediate necessity.

In other words, now that the purchasing power of Professor Irving Fisher's 1926 dollar is 107 cents, some are secretly hoping that business failures may tend to increase its purchasing power still further. The man who is thinking of building a house will wait awhile, to see if the price of the necessary materials will not decline, if unemployment will not force the acceptance of lower wages for masons and carpenters. The prospective buyer of a new car is inclined to defer the purchase, to see if the reductions made by Chevrolet, Hudson, Oakland-Pontiac, and Willys-Knight will not be extended to other favorite makes. The radio industry has been hard hit, and many believe that good bargains may be obtained by waiting. The trend may be selfish, but it is widespread. Even brokers have been known to assure clients that the buying of stocks might be delayed with advantage.

This present psychological attitude in regard to buying has hit copper hard, all the harder because opinion is general that the metal is selling at a good figure, and that a price change, if it comes, will be down rather than up. But the buying power of the public is there, even if not on exhibition. When it reasserts itself, copper will have its share of the business, and stocks of the metal that are in the hands of producers will no longer continue to increase.

The Engineer Must Develop Personal Salesmanship

MERIT often hides itself, and reward goes elsewhere. Mediocrity in attainment may secure greater recognition than fine achievement. In these days of intensive reading and prolific writing, publicity plays an important rôle, with propaganda as a smoke screen to deflect attention only into one channel.

The engineer must also be a salesman—of his own abilities, of his own inventions. Not alone does he suffer because most people are herd-minded in their ideas, possessed of little courage to resist group opinion, with no thought of questioning the logic of what they read in a favorite newspaper, the choice of which usually follows a political preference.

At one of the more important art exhibitions of the past year a picture was hung sideways by mistake. Viewed thus it appeared to have unusual merit in the eyes of the judges, who, unaware of the transposition, awarded it the second prize. A cynic remarked that had the object been hung upside down it might well have secured the first prize. The incident has made the artist famous.

A popular tendency is to scorn what is readily understood and to prefer that which lacks the efficiency and charm of simplicity. Intellectual dishonesty is no monopoly of a group of "artistic" faddists. Fashion also exerts a powerful influence among the many members of the engineering fraternity whose status depends in considerable degree on collegiate attainments—who see in the frills and furbelows of a complicated flow sheet an opportunity to prevent the person of natural rather than acquired intelligence from applying direct reasoning to the solution of a simple problem.

Science is organized common sense. Engineering is the application of that common sense. The field for initiative and invention is open to all who have a keen intelligence rather than a retentive memory, and who possess acumen, patience, zeal; but the rewards occasionally go to those whose most highly developed ability is personal salesmanship.

The Changing Concept of Research

RESEARCH and experimentation have progressed during the last decade as never before. The number of industrial organizations maintaining research facilities has more than doubled, and the capacity of those in existence has been greatly augmented. An interesting development is the increasing amount of research work, conducted in universities and technical institutions, that is directly sponsored and financed by industrial organizations. Groups of manufacturers are also combining their efforts by maintaining trade organizations that are engaged in laboratory experimentation and development work, in addition to market studies and business research, a fact that incidentally speaks highly for modern business methods. Co-operation and exchange of ideas are displacing secrecy and distrust, and a great amount of unnecessary duplication is thus avoided.

Important discoveries are made from time to time as a result of this research, discoveries that justify the large investment of capital. No better illustration of the fact that such results are forthcoming can be given than the following quotation from *Engineering and Mining Journal,* issue of January 9: ". . . in the year closed, more than a fifth of the total income received by General Electric was for electric apparatus which only ten years ago was either unknown or of negligible importance commercially." Or perhaps reference to the radio industry might be even more convincing. The development in industry and invention has been so wonderful that the word "impossible" is gradually being eliminated from the vocabulary. Limitations imposed by time and space are being pushed back, and the ordinary man, if there be such, is, in some measure, at least, being relieved from toil and drudgery, and is attaining a higher standard of living, with increased time for leisure and for the enjoyment of the better things in life.

Industry is quickly learning that curtailment of research activities during times of adversity is as weak a policy as cutting down advertising during a business slump. If such activities in a time of prosperity return full value for money invested, discontinuance during a period of depression, when every avenue for income should be left open and every chance of adding to the profit should be exploited, is nothing short of folly. Not long ago a general order to cut expenses would result in

the immediate suspension of research and investigation work. To note that this policy is being discarded, and that some concerns even go so far as to meet such conditions with intensified research, is highly gratifying. Let us hope that the year just entered upon will not see any diminution in research activities.

Another encouraging sign of the times is the great amount of purely scientific investigation undertaken by many of the larger industrial organizations in the United States. Sometimes the returns from this work may be difficult to find in the financial statements, but nevertheless, this addition to human knowledge is usually converted into cold cash where no such returns were expected.

The old conception of a research worker as an individual of eccentric characteristics, hidden away in obscure, crowded quarters, handicapped by lack of facilities, and merely tolerated by his employers, is rapidly giving way to efficiently managed research organizations, capable of anticipating the problems of the day, trained and equipped to solve them, and justifying the confidence placed in them.

Plant and Shops Require Adequate Heating

PROPERLY HEATED mine and mill plants promote efficiency in operation and shop work where climatic conditions are severe, as they are at many properties during the winter and spring months. Few managers neglect to provide heat in their change houses, where it is obviously necessary. Milling plants are also heated at some properties, and efforts made to warm the shops. But the heating equipment is usually extemporized out of old boilers and pipe. Elsewhere, stoves or salamanders are used. These expedients, invariably inadequate, may suffice for emergencies, or if only temporary use is indicated; but where a plant is likely to operate for several years, the heating equipment and its installation should be engineered as thoroughly as in any other feature of the operation.

The efficiency of standard heating equipment leaves little to be desired, but the variety of apparatus available to suit all conditions is not widely appreciated by mining engineers and managers, perhaps because their attention has been concentrated on the more important phases of the work. Nevertheless, the provision of adequate heating equipment that requires a minimum of attention is necessary to maintain consistent results.

Consideration should be paid to the heating problem when plants are designed. Selection of the proper equipment at the start will insure the efficient consumption of fuel, low maintenance cost, and no trouble from breakdowns. Automatic-control equipment for heating systems is available. Resultant economies soon pay for the initial expense.

Building design is also a factor in controlling the cost of heating. Better wall and roof construction, more efficient window and door design, will reduce heat leakage. Good engineering requires that these details be studied in advance of the design of a mechanical or metallurgical plant that is expected to operate continuously under severe climatic conditions.

Curtailment, Unemployment, and the Five-Day Week

STRENUOUS EFFORTS are being made under the leadership of President Hoover to prevent the current threatened slowing down of business from having too pronounced an effect on the fundamental industrial activity of the country. Large corporations are being urged to find work for hands that might otherwise be idle, pending a return of demand for goods and services by the ultimate consumer at something approaching the former rate. The advisability of making repairs, installing more efficient machinery, revising flow sheets, cleaning up neglected corners of the plant, and similar forms of activity not immediately productive, is being emphasized.

This general idea can be applied to the mining industry only partially. The increased demand for practically all metals and non-metallic minerals last year led most of the larger organizations to put their plants in the most efficient working order, or to embark on plans which have been progressing for many months. There is little incentive just now to start anew in expanding the capacity for the production of any mineral product. But mine development, in many instances, fell behind during the boom period of last year, and can now appropriately be carried forward with renewed vigor, as is being done by many companies—Anaconda, for example. In the Anaconda properties, in spite of the considerable curtailment that has been made in metal production, no necessity has arisen to lay off any men. To be sure, if a man absents himself without good cause he has little hope of coming back on the payroll, and a man out of a job will find no encouragement to hang around the time office, but no man has been removed from the payroll because of curtailed operations.

In the old days, before any one heard much about labor turnover, hiring and firing were much more freely indulged in than is the practice today. Now, an employer thinks twice before turning a good employee loose in a mining camp in the dead of winter, even though there is no real need for his services and no labor union to be offended. This is partly attributable to a greater realization of the employers' responsibility to the employee, and partly to an improvement in the quality and a decrease in the quantity of labor available.

Increased development work and odd jobs, however, cannot last indefinitely, and unless the demand for copper, zinc, and some other products of our mines increases soon, an actual curtailment in man-days must follow. An attractive plan for most companies who find it necessary or advisable to curtail output would seem to be the temporary adoption of the five-day week. The seven-day week of two decades and more ago has been well supplanted by the more civilized six-day week in our mining camps, and the five-day week is not unknown in American industry, even where no reason exists for taking care of an excess supply of labor. Wages in many mining districts today are sufficiently high to meet family needs if the breadwinner work only forty hours a week, particularly if an extra day is available for working about the home, or perhaps for pay elsewhere. Then, too, if Mr. Ford's idea has merit, consumption of commodities, including metals, might be stimulated by more of our population having an extra day to consume and enjoy their share of the products of a highly mechanized industrial age.

Fred C. Carstarphen

Improving on Rope-Tramway Location

By Using Angle Towers and Stations

"WHEN building a ropeway," says the writer of the article on ropeways and tramways in the fourteenth edition of the Encyclopedia Britannica, "the overhead rope should run in a bee line from place to place." This contention assumes that the flight of the bee is always straight. This is not so. Moreover, the advice is not sound. A consulting engineer of Denver, Colo., who has specialized successfully in the design and erection of rope tramways, discusses in this illuminating article the various problems involved, and offers constructive suggestions as to the most economical and efficient type of design.

A STATIONARY-CABLE tramway involves the use of stationary track cables to support carriers propelled by an independent traction rope. In such a system the carrier has the freedom of the terminals. It is fitted with a device, called a grip, for seizing the traction rope, a process called attaching. The releasing of the traction rope is called detaching. Unfortunately, the methods of attaching the carrier to and detaching it from the traction rope have not as yet attained automatic perfection. They are usually carried out under the supervision of the station crew. This increases the cost of labor in the transportation summary. Accordingly, any plan of operation involving attaching and detaching must yield to automatic methods, which, in turn, are influenced by the position of the traction rope.

The traction rope may be below the track cables or above them. When below, the carriers have underhung grips. When above, overhead grips. Fig. 1 and Fig. 2 illustrate the appearance of these two types of carriers.

When the traction rope is beneath the track cable, any down pull it may impart to the carrier is in the direction of increased stability with regard to the carriage staying upon the track cable. Owing to the eccentric position of an overhead traction rope in the grip, any down pull is an overturning force that may derail the carrier. The side position of the traction rope is illustrated in Fig. 3. In the underhung position the plane of the traction rope may be made to coincide with the track cable, as illustrated in Fig. 4. Accordingly, one may conclude that the overhead grip has a limited field, whereas the underhung grip may be regarded as having the proper position for general service. The importance of this conclusion will be seen in the following discussion.

If a rope tramway is to be built in a bee line over mountainous country it must of necessity cross valleys, ridges, and ranges, all or in part. The higher the ridge, the greater the tension in the traction rope. This disadvantage can be met only by strengthening the hanger, increasing the holding power of the grip, using a larger track cable and a larger traction rope, and increasing the power to take care of friction losses. Then, because of all of the increases in weight of equipment, the cable supports become more numerous and expensive, and the cost of the installation mounts almost as fast as the summit of the ridge rises in elevation. In crossing deep and narrow valleys the reverse is true, but slopes and ridges far exceed the number of gorges. The bee-line specification leads away from considerations having to do with economic location, defined as "the determination of the proper relation between construction and operating expenses, and the discovery, in any individual case, of that location which will afford the most economical cost and operating expense."

Many illustrations may be cited of faulty location of rope tramways because of this bee-line assumption, with hardships imposed on the management and operating crew. However, none will better illustrate the point to be made than the tramway of the Braden Copper Company in Chile, the capacity of which is 100 tons per hour of copper concentrates, with a length of 21,550 ft. For 12,000 ft. from the loading terminal the location of the line has an almost uniform fall totaling 700 ft. Then, this bee-line criterion carried it upward 650 ft. to the summit of Copado Bluff, situated but 14,000 ft. from the loading station. The formidable appearance of this barrier is shown in Fig. 5. A change in alignment would have enabled the tramway to skirt this mountain wall, with construction and operating costs that would appear attractive when compared with the real ones.

This bee-line principle applied to rope-tramway location has been an "old man of the sea," retarding recognition of the fact that such installations are the products of engineering skill and competent manufacture, worthy of confidence, as reliable and economical systems of transportation. When competently designed and supervised, rope tramways are in a class by themselves in affording cheap transportation, being

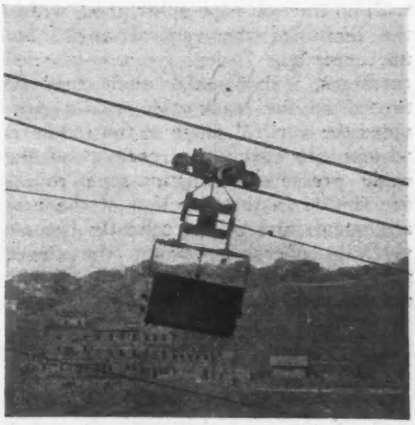


Fig. 1—Underhung grip used with a four-wheel carriage

able to compete on the level with all kinds and classes of surface-haulage systems, including railways under 30 miles in length. Of course, in regions with steep gradients the rope tramway holds the field.

To escape from this bee-line delusion, ready and economical methods of changing the alignment of rope tramways have been devised. These may be summarized as follows:

1. By following past precedent and building angle stations equipped with tramway rails curved to accommodate the angular change in location, thus permitting the detached carrier to coast around the curve to the attacher, with the aid of the tramway crew. The station may be made more complex by cutting the traction rope, thus making the structure a combined angle and con-

trol station. This method is not the best, because of the operating costs.

2. By using angle towers, with underhung grip carriers.

Fig. 2—A two-wheel carriage equipped with overhead grip

3. By using overhead grips and deflecting sheaves.

4. By using underhung grips and guide sheaves.

Whenever a tramway, equipped with underhung grips, is so located that a vertical intersection angle is formed by the track-cable tangents at the saddle, with no traction-rope uplift, then, within the limits of the vertical angle, but not exceeding 7 deg. for two-wheeled carriages, a horizontal angle may be turned on the track-cable saddle, provided the vertical plane of the saddle is adjusted to carry the resultant of the cable pressure. Traction-rope rollers are shifted in the direction of the new alignment, and may frequently become vertical rollers protecting the tower posts. The adjustment of the saddle usually results in the saddle beam assuming a sloping position, so as to aid the tilting of the saddle from the horizontal position.

On favorable ground, this principle may be adopted to swing the tramway location on curves having a minimum radius of 1,000 ft., and a central angle that is limited only by structural considerations. Most tramways cross rolling terrain favorable for the angle-tower method, so the locating engineer has more freedom than is generally recognized. I have used the angle-tower method with satisfaction. It is not new or novel.

A modification occurs when the angle tower is turned into a semi-angle station. This method uses a curved tramway rail from 8 to 25 ft. long. An illustration of such a station is shown in Fig. 6. The change in alignment and the bank of vertical traction-rope rollers are distinctly shown. Multiple rollers are required to cover the range of traction-rope position, which varies with the loading. In this method of throwing angles with underhung grips, the traction rope drops to the clear, and its rollers are below the carrier, so that no necessity arises to pass it between the traction rope and its guide sheaves.

Advantage may be taken of the position and a slender construction of overhead grip jaws to pass them in either direction around the periphery of deflecting sheaves of reasonable diameters, say 8 ft., for a velocity of 200 ft. per minute, to 17½ ft. diameter for velocities of 450 ft. per minute. The carrier is supported on a properly curved rail, and kept in position by guides. Both overhead and underhung grips will readily pass around such deflecting sheaves if the jaw of the grip only lies between the sheave rim and the traction rope. Accordingly, many so-called automatic tramways have been built so that the carriers pass around the tail sheave and return to the loading terminal without the aid of the crew. The West Penn Power Company's slate-disposal tramway at Beechbottom uses this principle to make a circuit without re-entrant angles. The grip jaws come in contact with the rim of the deflecting sheaves, so the points of contact must be carefully treated to prevent violent oscillations that may derail the carrier. Fig. 7 and Fig. 8 show the position of the rail, the sheave, and the guides for the 180-deg. sweep of the carrier.

When angle stations using overhead grips are built on elevated locations, so that the traction rope has a down slope, some designers have found it expedient to use sliding-guide rollers, to make sure that the traction rope does not jump the deflecting sheave. Such an arrangement is shown in Fig. 9. The deflecting sheave is usually 12 to 15 in. above the rail, because of the height of the overhead grip. Accordingly, the

Fig. 3—Side position of traction rope when overhead grips are used

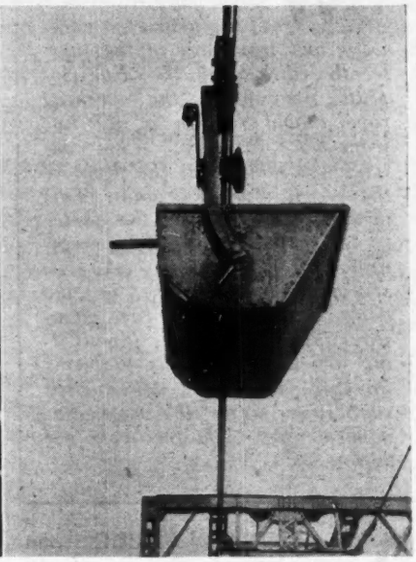


Fig. 4—With underhung grips the traction rope and track cable are in the same plane

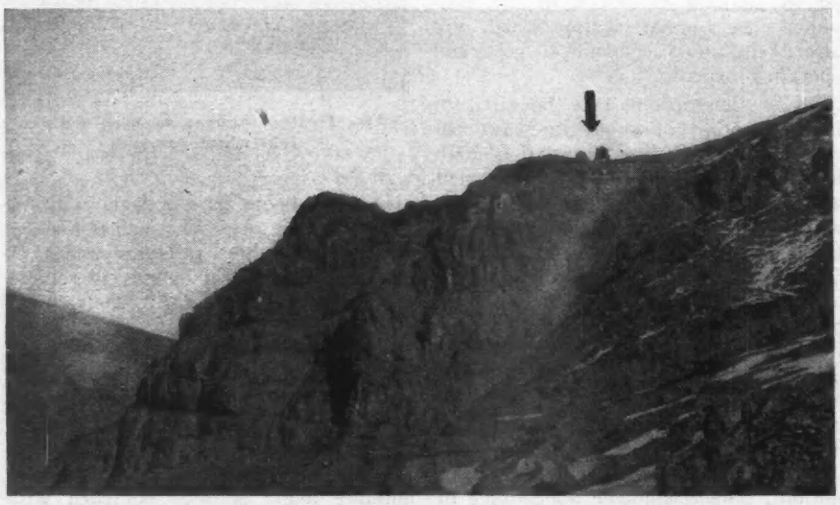


Fig. 5—Aerial tramway of the Braden Copper Company passing over Capado Bluff, 650 ft. high, in Chile. The arrow points to tramway curved-rail stations on top of the bluff.

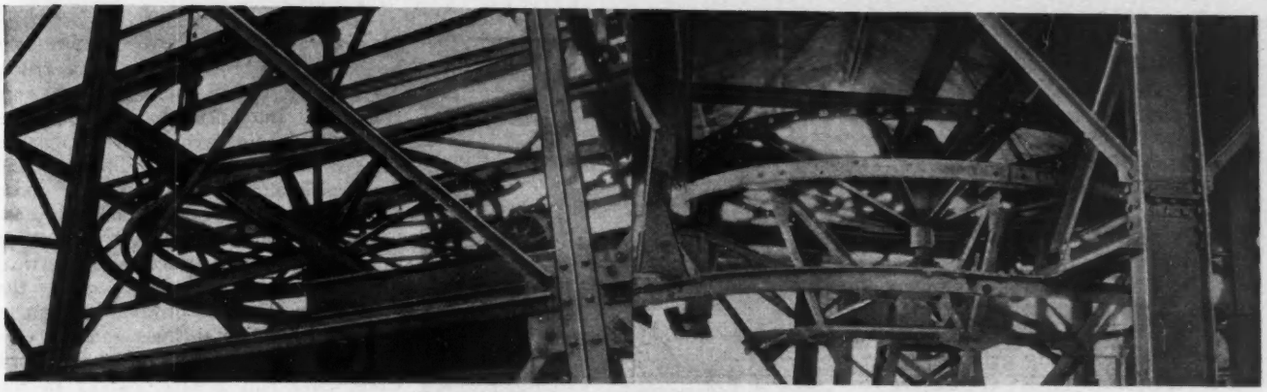


Fig. 7, left top—Arrangement of rail sheave, and guides for 130 deg. turn of underhung-grip tramway

Fig. 8, right top—Arrangement of deflecting sheave, rail, and guides for 180 deg. turn of overhead-grip tramway

Fig. 6—Curved-rail and angle station on tramway of the West Penn Power Company, Beechbottom, W. Va. The angle is more than 10 deg.

guide sheave must intrude upon the space occupied by the carrier, unless one or other is shoved to the clear. before the traction rope drops below its surface. This illustration (Fig. 9) shows two shoes for tandem rollers. The assembly of the angle station is shown in Fig. 10. It is an overhead-grip angle station built for the Alpha Portland Cement Company near Catskill, N. Y. Two 12-ft. diameter sheaves overlap, and the carriers are deflected accordingly. The speed of the line is 350 ft. per minute. The quantity of limestone accumulated in the few months of operation prior to the taking of the picture emphasizes the difficulty of adjusting the station to the hopes of its designer. Certain limitations of the overhead grip, as previously described, restrict its use to a few special lines of favorable location.

The ideal angle station is one that can be built in a hollow, or on the plain, or on the hilltop, without fear of its ability to function, but limited only by considerations that are inherent in rope tramway design and operation. To fulfill this ideal, underhung grips must be used. The difficulty presented

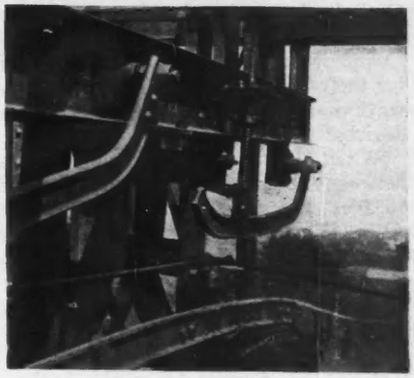


Fig. 9—Sliding rollers guide traction rope to deflecting sheaves

it will now be shown that the solution of the problem was so easy that the wonder is that all angle stations have not been designed on this principle.

To bring the subject from the abstract to the concrete: The Pittsburgh Coal Company decided, a short time ago, to connect its Champion No. 4 or Warden washery with the Ocean mine, likewise the Champion No. 5 or Banning No. 1 washery with Banning No. 2 mine, by heavy-duty rope tramways. These tramways are of such sturdy construction that they are in a class by

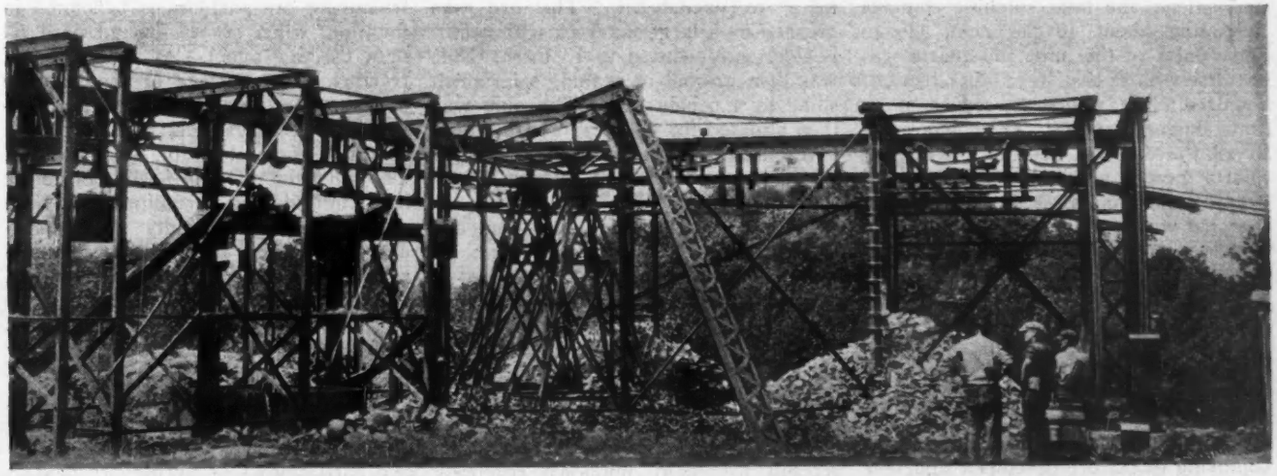


Fig. 10, above—Angle station on the overhead-grip tramway of the Alpha Portland Cement Company, near Catskill, N. Y. Capacity of this tramway is 150 tons per hour at a line speed of 350 ft. per minute.

Here an overhead shoe is raised by the carrier, and a system of links pulls the roller out of line, but sends it back by passing the carrier between the traction rope and the guide sheaves seemed to be a hard nut to crack, but themselves when compared with other rope tramways built in the past.

Although the sites of the two tram-

ways were 15 miles apart, the bee-lines ran in the channel of the Youghiogheny River. It was decided to take the lines out of the river and use angle stations of 48 deg. and 53 deg., respectively, for Warden and Banning.

Two of the most prominent of American rope-tramway companies urged the use of stations equipped with attachers and detachers, but, as consulting engineer for the Pittsburgh Company, I decided that the angle-station problem must be satisfactorily solved for tramways using underhung grips and four-wheel carriers. It is a pleasure to record the readiness with which Mr. Carl Lesher, vice-president, and the other executives of the Pittsburgh Coal Company acceded to this decision. But for their loyalty and vision, these tramways would be equipped with out-of-date devices.

When this particular hanger passes between the traction rope and the guide sheaves the rope is moved outward 20 in. The lateral push is not less than 4,000 lb. when displacing the traction rope on the empty side of the line. This consideration immediately determined the "hand" of the tramways. Banning is right handed, Warden left handed—that is, the carriers leave the loading station on the right or left hand of an observer facing the discharge terminal. In other words, the Warden alignment is an angle to the right, Banning an angle to the left.

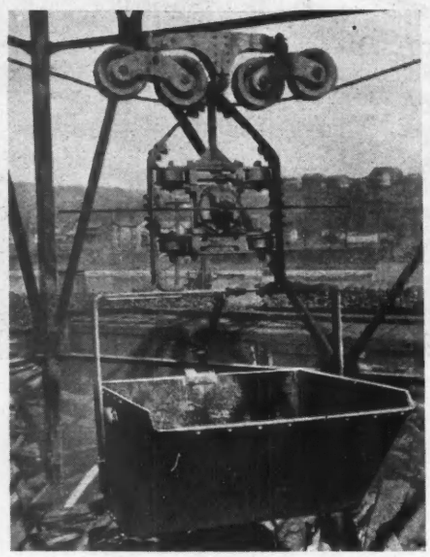


Fig. 11—A carrier equipped with track rollers for angle station operation

How can a load of two or more tons be carried? Most easily on a truck. So the hangers of these carriers were converted into trucks, by equipping each with four symmetrically placed flanged wheels, 6-in. in diameter and Timken mounted. Nothing is more simple than to provide a track for these wheels to run on, although the guide rails are in the surface of a vertical cylinder. After this was done, the problem was one of ordinary design to support the guide sheaves and the vertical track. The trucks of our modern street cars run around curves in the horizontal plane—far more difficult than to support the load on an overhead rail and keep the carriage on the track by the flanges of the truck wheels riding on the heads of the horizontal guide rails.

The problem proved so simple of solution that little more remains to relate. When these tramways started the usual troubles developed in adjusting the old "reliable" equipment, but the angle stations went into service with a perfect score, thus adding another reason why the bee-line method of locating rope tramways should no longer be entertained in up-to-date rope-tramway circles.

Effect of Heat in Cyaniding and Flotation

WHILE testing the amenability of an ore to cyanide treatment, I had an opportunity to observe how the physical characteristics under certain conditions affect cyanide consumption, writes Victor I. Zachert, from San Francisco. In this particular instance the ore consisted of a white quartz impregnated with iron pyrite, marcasite, and galena, the total sulphide contents averaging about 10 per cent. From some parts of the mine the quartz was extremely hard, that from other sections required little effort to reduce it to slime during grinding. The composition of all the ore was constant. The soft quartz gave a nominal consumption of cyanide and lime, after 48 hours' agitation, but with the hard ore the consumption was so high that cyanidtion was prohibitive.

In attempting to understand the cause of this discrepancy many theories were formulated. While crushing a sample of the hard quartz in the rock breaker I observed that a flash of light was emitted at the moment of fracturing, and it occurred to me that the sudden rupturing of the ore developed sufficient heat in the interstices of the fracture to ignite and partly decompose the sulphides, liberating the iron, which subsequently combines with cyanide to form ferrocyanide.

Those who have been around a fine-grinding mill cannot help noticing the rise of temperature in the surrounding atmosphere. A mill discharge may show an increase of 20 deg. above the temperature of the feed. Some heat is contributed by the friction of the grinding medium. Finely divided metallic iron is acted on by cyanide solution to form ferrocyanide, so precautions were taken to exclude it. The ore was crushed on a large flat rock with a flint boulder and reduced to 10 mesh. This was then ground in cyanide solution to slime in a pebble mill. The pulp was then agitated for 48 hours and the gold extraction was 5 per cent better than in the treatment of the soft ore, but 75 per cent more cyanide was consumed.

In cyaniding concentrates or ore having a high percentage of sulphides the consumption of cyanide shows a tendency to be high. Mineral sulphides dissolve in cyanide solution, but no theory has been advanced to explain what causes the breaking up of the sulphide mineral combination during grinding in cyanide solution. The heat of friction and ignition of the ore may account for many unknown reactions that occur grinding in cyanide solution, and these may result in not only destroying cyanide but also in retarding or completely nullifying the extraction of gold and silver.

Heating a cyanide solution in the presence of ore usually destroys cyanide by the formation of acetates, formates, and other compounds, at a temperature not much above the summer heat of a tropical climate. As the heat developed at the fracture of breaking particles of ore would be greater, the chemical changes would be accelerated.

Heat developed by the friction of fracturing ore particles is beneficial in flotation, when ore is ground with oil or a frothing agent. At the instant of fracturing the surface of the sulphide particles becomes hot, dry, and enveloped in a gaseous atmosphere, a condition favorable for oil adhesion. The beneficial effect of feeding oil to the ball mill during grinding has been suggested when difficulty was experienced in floating certain ores at Inspiration in the early days of flotation.

A body exists as a solid by the force of cohesion, which keeps the molecules united. They can be separated only by chemical decomposition or by the exertion of a greater physical force than that controlling cohesion. An interesting experiment may be made with two hard chunks of pyritic ore held in both hands and then violently struck together. A flash of light will follow, and fumes of sulphur dioxide will be emitted—an illustration of the reaction of physical forces and chemical decomposition.

Diversified Mining

Winnfield, La., Has Reserves of Limestone, Salt, Gypsum, Barite, and Iron Ore in Close Proximity

William Crooks

Little Rock, Arkansas

INTERESTING mineral deposits are being developed in north-central Louisiana by the Southern Mineral Company, which owns about 1,700 acres near Winnfield, which is situated along the Louisiana & Arkansas, the Chicago, Rock Island & Pacific, and the Tremont & Gulf railways. For many years this property has been of particular interest, owing to the fact that on the surface occurs the only limestone in the large area bounded by the Gulf of Mexico, the mountainous section of Arkansas, the central Texas chalk limestones, and the Birmingham, Ala., district. For many years a limestone quarry and rock-crushing plant have been in operation. Wells and test holes have shown other mineral deposits, in probably commercial quantities, of salt, gypsum anhydrite, gypsum, barite, pyrites, and iron ore.

All of the deposits have been found in an area of about 200 acres. Government topography sheets show an elevation at the rock quarry of 200 ft. above sea level and a relief of 70 ft. The area in which the deposits are found is basin-shaped, being 50 to 70 ft. lower than the surrounding hills. One side, lower than the others, affords drainage into an adjacent bayou.

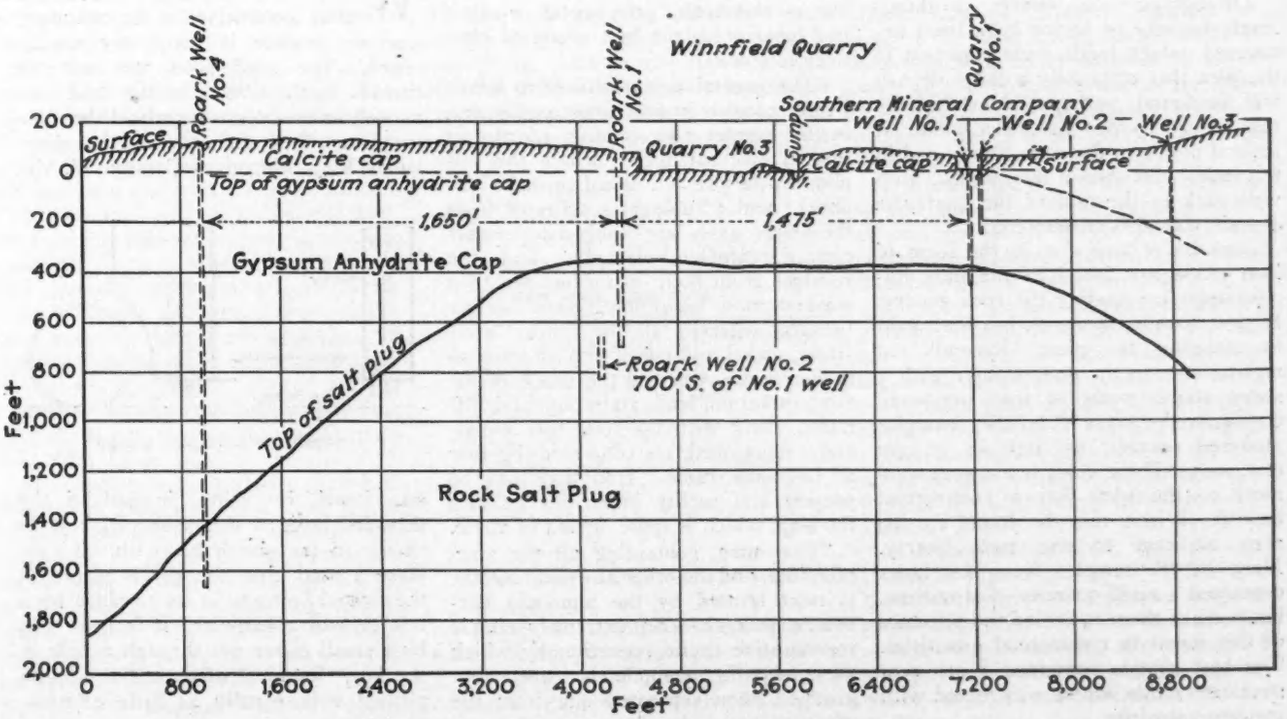
Test holes and deep wells indicate the presence of a salt dome, the high point of which is within 450 ft. of the ground surface. This is one of the 46 salt domes of Louisiana. It has an advantage over many of the others in that it is fairly close to the surface and situated alongside railroad transportation facilities. The dome occupies an egg-shaped area, the major axis running northeast-southwest for about three-quarters of a mile and the minor axis running southeast-northwest for about one-half mile. Chemical analyses of samples show that the salt is probably as pure as that found in the three salt mines in south Louisiana, indications being that the salt will average 98.5 to 99 per cent sodium chloride.

Immediately above the salt is a deposit of gypsum anhydrite of the following chemical analysis:

	Per Cent
Loss on ignition	1.85
Calcium oxide	40.60
Iron and alumina oxides	0.80
Magnesium oxide	Trace
Sulphur trioxide	56.46

This material has the characteristics of a natural gypsum cement and will set to an unusual degree of hardness when mixed with water. Indications are that the deposit is sufficiently large to furnish material for a large commercial plant over a long period of years.

In some of the area above the salt, a mixture of anhydrite and pyrites is



Profile sketch showing salt dome of Southern Mineral Company

round, and also a mixture of anhydrite and gypsum. Lying above the anhydrite and the anhydrite mixtures is a deposit of gypsum, more than 30 ft. thick. The gypsum rock outcrops at several points in the limestone quarry floor. An analysis of a sample of the gypsum follows:

	Per Cent
Loss on ignition	20.80
Silicon oxide	0.25
Oxides of iron and aluminum	0.44
Calcium	23.58
Sulphate radical	54.64

Above the gypsum is the surface deposit of limestone. The limestone is described in a publication of the U. S. Geological Survey as "a very coarsely crystalline, white limestone with thin, finely grained gray bands." The limestone cap rock has been shattered, with the result that it is found in boulder formation, in some instances with numerous cavities that have been filled with surface earth; but the major part of the deposit may be considered a massive formation in a shattered condition. Most of the lime rock is high-calcium rock suitable for lime-making purposes. About fifteen million tons of easily accessible rock is still available.

At certain points in the quarry face quantities of practically pure barite are found in the overburden. The rapidity with which the outcroppings increase in size as the quarry face is opened in a southwesterly direction indicates the possibility of a considerable deposit of barite. Following is an analysis of a sample taken from the outcropping:

	Per Cent
Loss on ignition	0.48
Silicon oxide	1.84
Oxides of iron and aluminum	0.28
Barium	57.00
Sulphate radical	40.18
Calcium	0.10

Throughout the quarry workings small deposits of barite have been uncovered, which lends encouragement to the idea that ultimately a large deposit will be found, perhaps underlying the cap rock. Pyrites has been found at several points in the rock quarry and in test holes sunk within the quarry. In a well sunk to the east of the quarry, a deposit was also encountered.

Deposits of iron ore in the form of iron oxide are found in the hills immediately surrounding the rock quarry. Little attention, however, has been paid to these in the past. Recently, in making cuts in the quarry floor with a steam shovel veins of iron ore were encountered, some of the samples analyzed running as high as 56 per cent iron. These veins lend encouragement to the idea that a commercial deposit of iron may be found in the area adjacent to the rock quarry. Many of the samples from test holes contained a small quantity of strontium, but none of them indicated the presence of this metal in commercial quantities. The best sample contained 5 per cent strontium oxide, which was mixed with gypsum anhydrite.

Fifty-five and 70 miles, respectively, northeast of the mineral deposits are the Richland and Monroe natural-gas fields, with probably the largest reserve of recoverable gas in the United States. At Stirlington, in the center of the Monroe gas field, about 70 miles from Winnfield, is a large central steam-generating plant, from which plant cheap electric power for industrial purposes is available. To the west and northwest of Winnfield are large deposits of lignite. The deposits at Winnfield will undoubtedly play an important part in the industrial development of Louisiana and the Southwest.

Needless Waste of Metals Said to Occur in Smelting Tri-State Ores

A NEEDLESS WASTE of important metals occurs in the smelting of zinc-lead ores from the Tri-State district, asserts W. George Waring in the Joplin *Globe*. "These ores," says Mr. Waring, "have long been known to contain a higher percentage of cadmium than those of any other region in the world, yet it is all wasted into the air. Most of this very volatile metal escapes when the ores are roasted. A small additional amount escapes from the retorts during the smelting and the remainder is lost as an objectionable impurity in the zinc metal.

"Other valuable metals contained in the Tri-State ores are germanium, gallium, indium, and thallium, and these are wholly wasted in recovering the zinc. But all four, together with the cadmium and other elements of value, such as gold, silver, copper, bismuth, and sulphur, pertaining to ores of the mountain regions, can be almost completely recovered, along with the zinc and lead, and separately from each other, by means of a preliminary treatment, whereby the zinc may be distilled from retorts eventually, as at present, but as chemically pure metal, equal if not superior to the best grade of electrolytic zinc.

"The preliminary treatment to which I refer consists in first sintering the ore, in the manner now coming into use at several zinc smelteries, where the sulphur in the ore is utilized to make sulphuric acid. Sublimates collected from the sinter gases are leached to extract certain valuable elements, and the residues from both operations are then smelted in a high-temperature fuming furnace, whereby all the copper, gold, silver, nickel and cobalt are collected as molten matte, whereas the whole of the zinc, cadmium, lead, antimony, and bismuth, along with the four rare metals above mentioned, are recovered together as baghouse fume. Iron that may be present and earthy impurities go into the slag, which is quite devoid of value.

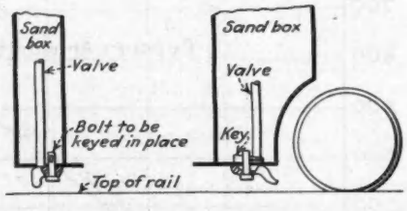
"The fume, containing all the zinc, cadmium, and the other aforesaid metals, is next treated by the ammonia carbonate process — an extremely simple regenerative cyclic operation by which the metallic compounds are first grouped, then separated one from the other as pure elements or carbonates. The same solvent is used over again, indefinitely. Undoubtedly, the most important feature, in respect to the zinc, is that it comes out finally as snow white, chemically pure zinc oxide ready for distilling with carbon in the usual way. The actual recovery of the metal as oxide is from 96 to 98 per cent.

"As first outlined, the process is, of course, not yet in commercial operation anywhere, but it has been developed in the laboratory and on a semi-commercial scale as the result of several years of intensive research. It has been reported on favorably by expert metallurgists. The most critical points in the development have been completely and satisfactorily solved only during the last year or so. All that now remains is to install on a moderate commercial scale a working plant to demonstrate costs of operation."

■

Locomotive Sand Pipe Keyed to Box

WHEN sand pipes are attached to mine locomotives in the customary manner, trouble is constantly experienced. The sand soon cuts out the threads in the bottom of the sand box, as well as the bolts which hold the pipes in place. This difficulty can be eliminated, R. J. Tillson, of Cassity, W. Va.,



Details of sand-pipe design

has found, by using, instead of the threaded bolts, a wedge-shaped key, as shown in the sketch herewith. To replace a sand pipe, the key is placed in the slotted bolt and is set to place by a few taps of a hammer. It is held thus by a small cotter pin through a hole in the key. Removal of a pipe is accomplished with equally as little effort.— *Coal Age.*

Air Separation Effective in the Non-Metallic Mineral Industries

Rubert M. Gay

ALTHOUGH air separation dates back to the earliest days and has been used to a limited extent for the separation of various non-metallics, only within the last ten years has this method become standard practice for separating many of these materials. In this article I shall outline the history of air separation briefly and explain in a general way with the aid of flow sheets the arrangement of separators in connection with various types of machinery used for reduction

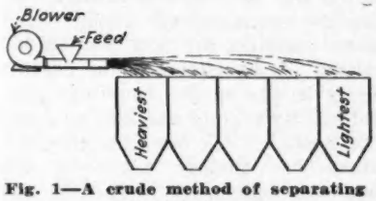


Fig. 1—A crude method of separating materials by air

of the commoner non-metallics. The reader should understand that the arrangement of plants varies with different grades of material and different requirements.

The earliest air separator was the wind which "winnowed the chaff from the wheat." For many years fans and blowers have been employed to create an artificial wind, which was directed through the material to be separated. The Fanning mill and the aspirator, used principally for cleaning grain, are examples of these types. Material was also introduced into a stream of air from a blower and passed horizontally over bins or around baffles, the heavier particles (being acted on more strongly by gravity) dropping out of the air current first, while the lighter ones were carried to the bins further away from the outlet (Fig. 1).

The cyclone dust collector has been used as a separator to a considerable extent. By arranging several of these collectors in series by connecting the outlet of one to the inlet of the next, a fairly satisfactory separation can be made. There is considerable difference in the general proportions of these dust collectors, and although some have a number of tangential inlets spaced around the circumference, the majority have only a single opening. The cyclone dust collector separates by a combination of two different forces: first, the centrifugal effect caused by the tangential introduction of the material at high velocity, and, second, that of gravity, which causes the heavier particles to fall out of the expanded air. If the air current is drawn out of the cyclone by a suction fan instead of being forced in by a blower, a partial vacuum is created within and a better operation obtained (Fig. 2).

A type of air separator which has been used for many years consists of an outer casing carrying a fan in the upper part; an inner or separating chamber below the fan which has openings in the top and bottom; and a lower inner conical section below the separating chamber, this cone having an outlet in the lower apex. The fan in the top of the separator draws air from the inner chamber and forces it into the space surrounding the latter, from which it enters the bottom of the chamber. Material to be separated is introduced into the separating chamber in various ways, the most common consisting of a

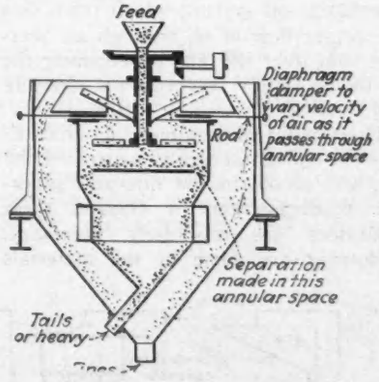

Feed
Diaphragm damper to vary velocity of air as it passes through annular space
Rod
Separation made in this annular space
Tails or heavy

Fig. 2—Gravity-type separator

revolving disk. Material is fed onto the center of the disk and is thrown off in a thin sheet by the centrifugal force created by the rotation of the disk. The air, passing upwardly through the annular space between the edge of the disk and the inner wall of the separating chamber, picks up the lighter material and deposits in the outer casing with a

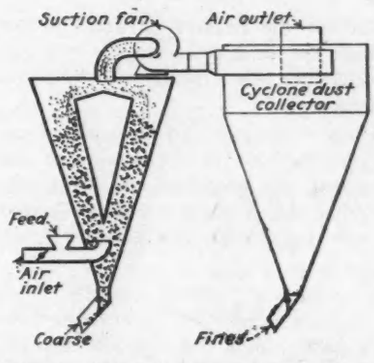


Fig. 3—High-velocity gravity separator

whirling action induced by the fan, which throws the material against the wall of the outer casing, down which it falls by gravity to an outlet in the lower end. In this operation the heavier particles fall by gravity and are collected in the cone below the separating chamber.

The weight of the particles carried up by the fan is determined by the velocity of the air, as it passes through the curtain of material thrown off by the distributor disk, those too heavy to be carried by the air current falling by gravity. To regulate the velocity of the air in the annular space surrounding the disk, dampers are commonly used, or variable-speed motors, or devices to change the speed of the fan. Fig. 2, shows a common type of low-velocity air separator which, with unimportant modifications, has been used for many years.

A somewhat different type of separator is shown in Fig. 3. This is a high-velocity gravity separator, the material being fed into a high-velocity stream of air entering the bottom of an expansion chamber, which has an outlet at the top connected to an ordinary cyclone dust collector, and an

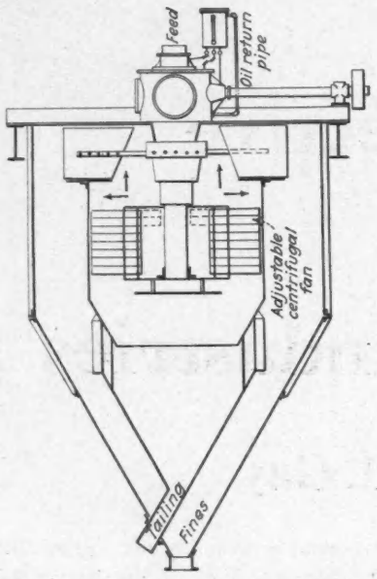


Fig. 4—The centrifugal air separator This has no dampers, all adjustments being made by moving the blade sections in or out

outlet for the heavier particles in the bottom, the velocity of the air entering the chamber being usually controlled by a damper.

Many objections can be made to the various methods of separation so far described, the principal one being the fact that the slightest variation in the air velocity changes the product. Another serious fault is that, in all cyclone and gravity separators, eddy currents are induced which make their action uncertain and variable. For fine separation their capacity is limited by the fact that gravity is the only means of removing the undesired particles and the weight of comparatively small particles is insufficient to cause them to fall out of even a slow air current.

About ten years ago an entirely new principle of air separation was introduced, and this has revolutionized the dry separating industry. This was the substitution of a positively created and adjustable centrifugal action opposed to a moving air current to separate the heavier particles from the lighter. With the gravity separator, the sizing is limited by the fact that beyond a certain point the weight of the particle cannot overcome the carrying effect of the air, but with the centrifugal, there is no limit to the fineness of particles that can be eliminated.

In the centrifugal separator (Fig. 4) the material is spread by a distributing disk as in the gravity machine, but instead of separating in the annular space surrounding the disk, practically all of the material is carried up into the separating zone above the disk, where it is positively rotated by means of a fan having hundreds of steps of adjustment. The centrifugal action generated forces the particles to the outside of the upwardly moving current of air and the heavier ones (being acted on more strongly than the lighter ones) reach the outside of the air column before the lighter ones reach the opening in the top of the chamber.

Inasmuch as the fan which causes the upward motion of the air is attached to the same shaft that rotates the centrifugal sizing fan, any change in speed effects both equally, the opposing forces remain balanced, and the size of the product is not affected. To distinguish the centrifugal from the gravity separator is easy as the former has no dampers or adjustable choke deflectors and requires no changes of speed to vary the product.

In the centrifugal separator, the driving mechanism and all moving parts are carried on heavy horizontal structural steel beams, which also carry the steel shell, and no vibration is transmitted to the sheet-metal casings. The centrifugal is fed through a hollow shaft of sufficient size to carry any amount of material the separator will ever have to handle, and it also has an automatic circulating oil system, which maintains a constant flow of oil through all bearings and over the gears, returning the oil to the supply reservoir for cleaning and cooling.

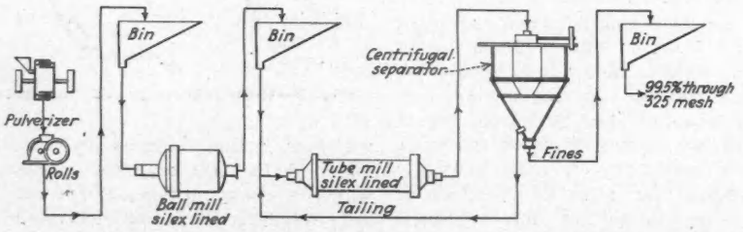


Fig. 5—Flow sheet showing air separation in a plant treating fibrous talc

Practically all non-metallic minerals may be advantageously separated by air, and to obtain the fine and superfine products now in demand these separators are absolutely necessary. Following are some of the materials successfully handled by modern centrifugal air separators; borate ore, borax, barytes, coal, shale, slate, phosphate rock, gypsum and plaster, limestone, hydrated and caustic lime, salt, garnet, emery, graphite, mineral colors, clay, borite, kaolin, magnesite, diatomite, talc, and fullers earth.

For many years fibrous talc had been ground in so-called dump cylinders, inasmuch as no air separators built prior to 1920 would handle this material. About ten years ago W. H. Loomis (whose foresight is proved by the fact that his company is today the largest producer of this material in the world) installed the first two centrifugal air separators manufactured. Some seven of these machines are now used by his company. A description of the Loomis plant as it was at that time was published in *Engineering and Mining Journal* of Sept. 1, 1923, but since then the business has greatly expanded, the amount of equipment increased, and many modern scientific methods have been introduced, together with a laboratory in charge of a competent chemist. The flow sheet published in 1923 gives a general idea of the arrangement of machinery, although some modifications have naturally been necessary to meet the varying requirements of a constantly growing business. The general flow sheet is given in Fig. 5.

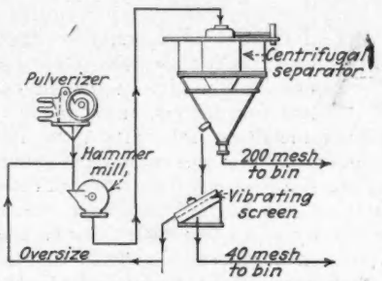


Fig. 6—Flow sheet of a plant producing roofing talc and filler

A considerable number of manufacturers of talc products are now using the same type of separators for making rubber filler, roofing talc, and various other products. Fig. 6 shows a typical flow sheet for such a plant.

To the Bedford Mining Company belongs the credit of being the first to install the centrifugal separator in a feldspar grinding plant. This was nearly ten years ago at that company's plant in Bedford, N. Y., and the original machine is still in operation and giving satisfactory service. This installation was soon followed by one at the Golding-Keene plant at Keene, N. H., where two of these separators were installed. This plant was fully described by Raymond B. Ladoo, then of the U. S. Bureau of Mines, in Bulletin 2396, published in September, 1922. It is

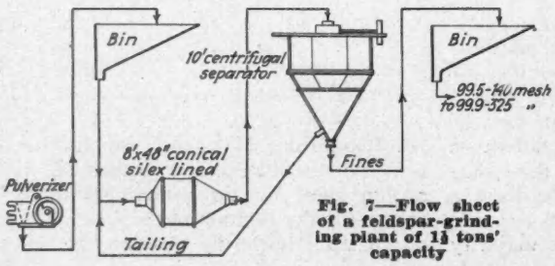


Fig. 7—Flow sheet of a feldspar-grinding plant of 1½ tons' capacity

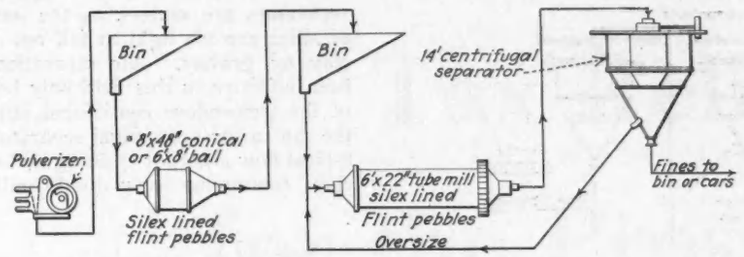


Fig. 8—Another flow sheet of a feldspar and quartz plant of 3-4 tons' capacity

operating today with no substantial changes from the first flow sheet, which is shown in Fig. 7, except that more mills and separators are used. Fig. 8 shows a somewhat more elaborate flow sheet. Since that time some fifty of these separators have been installed in the spar, silica, and quartz field, and they are now considered standard equipment on these materials.

Twenty years or more ago gravity air separators were used to a considerable extent in the cement industry, but as the requirements became more exacting these machines were discarded, for they could not meet the new specifications. By 1915 few if any plants in this country were using them on either clinker or raw materials. Shortly after the centrifugal separator was introduced, however, the Alpha Portland Cement Company, which has always been a pioneer in introducing new methods, installed one of these machines at its Jamesville plant, where it proved so satisfactory that practically all of its plants were equipped with the centrifugal. Between 35 and 40 have been purchased by this one company. Numerous other cement companies have installed this type of separator, including the Wabash Portland Cement Company, which uses such separators at both of its plants and has recently purchased two 16-ft. machines, which will be installed within the next month or so.

In cement plants so many types of mills are used, and the plants are arranged in so many ways, that to give a typical flow sheet is difficult. However, the practice in general is to hook the separators up in closed circuit with the grinding mills—that is, the mill product is elevated to the separators, the fines are removed, and the oversize is returned to the feed end of the mill. In some plants there is no room above the mills, and the product of several mills is conveyed to a battery of separators, sized, and the oversize returned to the mill feed bins. Recently tube mills having two or more compartments with separate outlets have become quite popular. With mills of this type separators may be used in closed circuit with the last compartment of two-compartment mills or with either the middle or last compartment, or both, in the three-compartment type. Wherever these separators have been installed they have improved the plant operation materially by regulating the mesh of the product and increasing the fineness and also the capacity. Fig. 9 shows a three-compartment dry-grinding Compeb mill having a centrifugal air separator in closed circuit with the intermediate compartment.

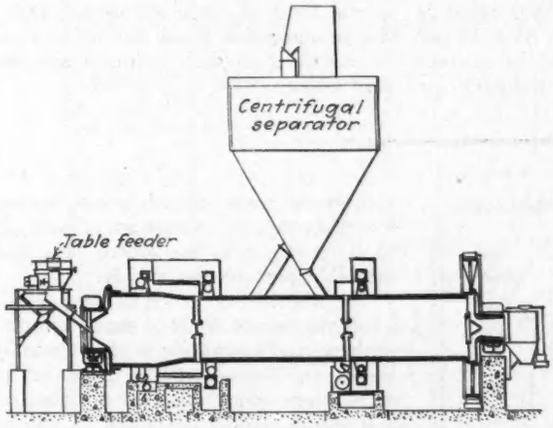


Fig. 9—A cement plant layout, showing a three-compartment dry-grinding Compeb mill with a centrifugal air separator in closed circuit with the intermediate mill compartment

Ground limestone is one of the nonmetallics which has a large use outside of the cement industry, and numerous plants prepare this material for agricultural purposes, rubber filler, paint filler, and many other uses. Most agricultural colleges recommend a comparatively fine product. Undoubtedly the tube mill is the most satisfactory means for producing this material, particularly if there is a market for rubber filler and the finer "air float."

The Limestone Products Company, Newton, N. J., was one of the first to realize the possibilities of producing a superfine air-floated product by the use of centrifugal separators. It installed it first machine a number of years ago and has since installed two additional machines to care for the increased demand. This company makes both agricultural limestone and air float, the latter testing about 99 per cent through 300 mesh. The flow sheet in Fig. 10 illustrates a practical ground-limestone plant.

Diatomite is used largely for filtration, insulation, polish, as an admixture in concrete, and for numerous other purposes. Its character varies greatly in different deposits and until recently no commercial separator has been found that would clean or grade it satisfactorily, and each producer has worked out his own crude apparatus for handling it. Nearly all of the plants now in operation use various combinations of cyclone dust collectors and bins, over which the material is blown.

Most commercial diatomite contains sand, broken diatoms, and dust and varies in mesh and weight because of the fact that it is impossible to regulate dust-collector products. Commercial gravity and high-velocity separators have been tried from time to time, but have failed to give even as good results as the crude home-made dust-collecting outfits. During the last two years a large amount of experimental work has been done on this material with the centrifugal air separator in the United States and by the Canadian Bureau of Mines, under supervision of experts on this particular material. Results have been extremely satisfactory, and the products obtained are far superior to those made by any other method. The results have been equally good on all of the various diatomites tested, including the light Florida material, the heavier from eastern Canada, and that

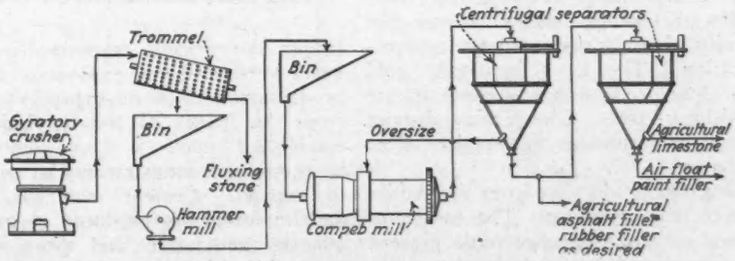


Fig. 10—Flow sheet of a limestone plant, producing fluxing stone, agricultural, and air-float lime

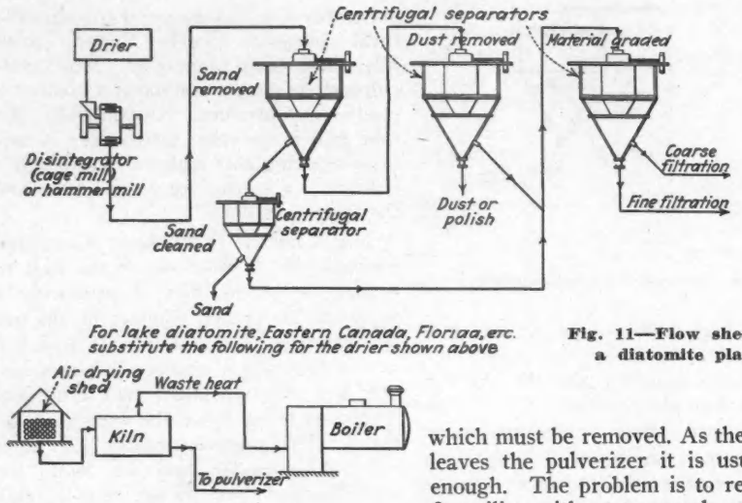


Fig. 11—Flow sheet of a diatomite plant

from Maryland, Virginia, and the Western states. The centrifugal separator has been found to remove all traces of sand, and as little or as much of the finest material as wanted, and it grades the product into as many sizes as may be desired.

Fig. 11 gives a typical flow sheet of a plant for removing the sand and dust and making two grades of filtration material. This unit can, however, be easily adjusted to produce any grade for which the raw material is suitable.

Clays such as kaolin, china clay and the like require treatment somewhat different from that demanded by most other materials because they usually contain silica and other foreign matter which must be removed. As the material leaves the pulverizer it is usually fine enough. The problem is to remove the fine silica without too much waste. For years water flotation has been used to clean these materials, but it has been found that the centrifugal air separator will do the work cheaper and better. At least a dozen of these machines have been installed in the clay field during the last year or so.

Silica as found in clays is often of almost microscopic fineness, so that it is usually necessary to resort to double separation—that is, taking off part of the fines in the first separation, then sending the oversize to a second separator, and again taking off the remainder. Sometimes a third separation is advisable and a recovery of 85 to 90 per cent can be made. Owing to the extreme fineness of this material, ordinary air separators are useless, as the particles of silica are too light to fall out of the clay by gravity. Air separation has been effective in this field only because of the tremendous centrifugal effect of the fan in the centrifugal separator. A typical flow sheet for cleaning and sizing clays containing finely divided silica is given in Fig. 12. When the silica is in the form of large grains of sand, a single separation is all that is required to remove it as well as lumps and foreign matter.

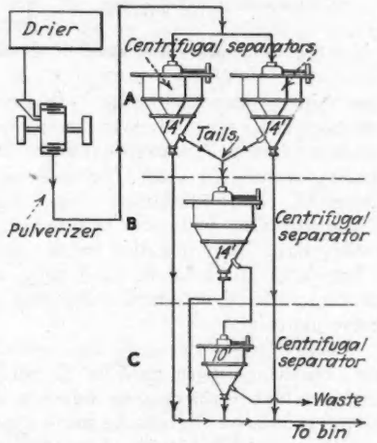


Fig. 12—A typical flow sheet for cleaning and sizing clays

For clays containing only coarse sand unit *A* is used. For clays containing fine sand units *A* and *B* are applicable; and for clays containing microscopic sand units *A*, *B* and *C*.

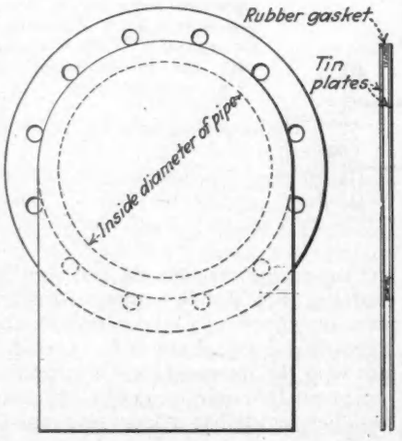
Mohave Desert Region

MUCH information about the Mohave desert region of California is presented in Water Supply Paper 578 by the U. S. Geological Survey. The region is arid and most of it is desert. However, it is the source of a considerable mineral production and has been prospected for many years. Its mineral production for a period from 1894 to 1925 inclusive, for the area covered by San Bernardino County, totals $121,130,505, of which metal production was $23,865,041; tungsten, $9,121,573; and the production of non-metallics, $88,123,891. Metalliferous deposits are small and scattered and production from them varies considerably. Exploitation of such deposits is attended with difficulties principally arising through the scarcity of water and inadequate transportation. The most important gold and silver production was made in the Randsburg area. The Calico district was at one time a noteworthy silver producer.

Tungsten production from the Atolia district still continues. The most important mineral production of the present and future will be in the non-metallic division. Borax deposits sufficient to supply the world's markets for many years are now being exploited. Potash production as well as byproduct borax from the brines of Searles Lake are established upon a firm commercial basis, and this industry may be expected to expand. Cement materials, lime, and limestone are produced in greatest quantity and value, and there is also a considerable production of building stone. The densely populated southern California areas afford good markets for materials of construction and the Mohave region is the source of a considerable part of the supply.

The information given in the paper is a reconnaissance study of the geography, geology, and hydrology of the region by David G. Thompson. A good set of maps gives added value to the publication, which should be useful to mining engineers and geologists who may be interested in this district.

■



Gasket is held between thin metal plates when being inserted between flanges

Placing a Soft-Rubber Gasket

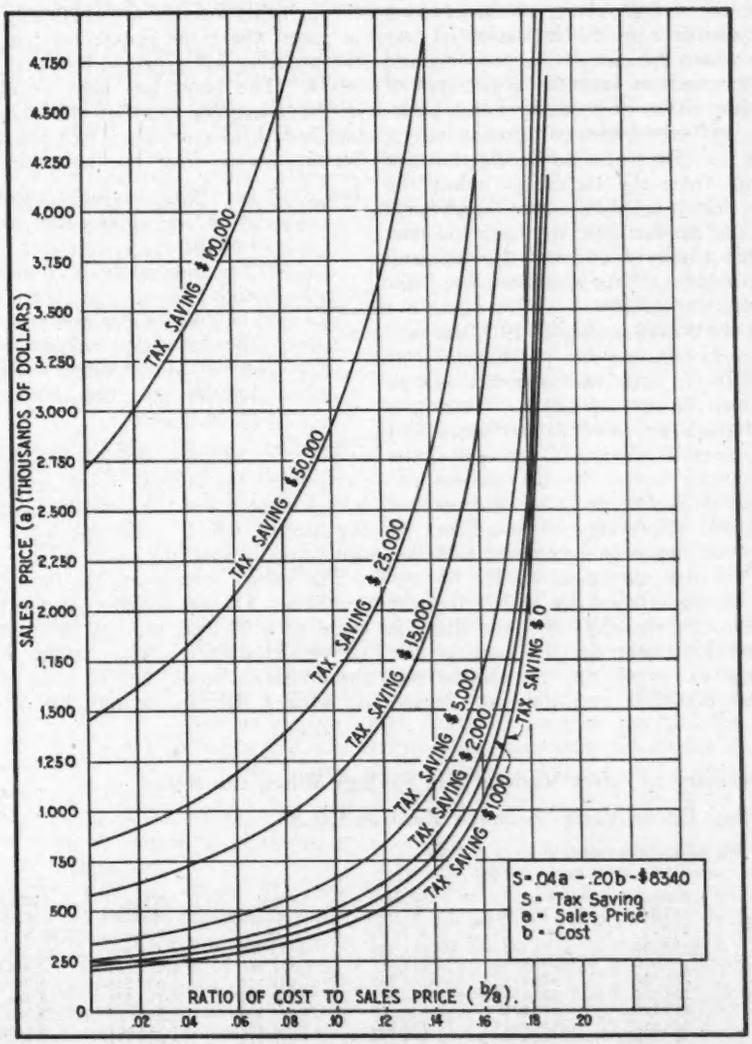
SEVERAL pieces of 14-in. water pipe had to be changed, and gaskets renewed. Everything went well until new rubber gaskets had to be inserted, writes a Von Euw in *Power*.

The space between the flanges was small, and difficulty was experienced in getting the soft gaskets into place. One of the pipefitters then suggested that two tin plates should be cut, of the shape shown in the accompanying sketch. The gaskets were laid between the two sheets and the three pieces then placed between the flanges. The sheets were then removed, one at a time, without affecting the position of the rubber gasket.

Tax Relief for the Prospector

Granville S. Borden

SECTION 102 (a) of the Revenue Act of 1928 should be amended. This section provides for a limitation on the surtaxes attributable to gains derived by prospectors from bona fide sales of properties or any interests therein, where the principal value of the property has been demonstrated by their efforts. The purpose of this article is to explain the reasons why this section of the law should be amended.



Curves of tax saving at various sales prices and ratio of costs to selling prices

The term "prospector," as used in this article, means "any individual subject to the federal income tax laws, who endeavors to demonstrate, through prospecting, or exploration and discovery work, that a mineral deposit or an oil and gas tract or lease has a greater value than recognized prior to his efforts."

From time immemorial it has been customary for a sovereign to reward the faithful in a manner commensurate in some degree to their services in behalf of the sovereign. In the United States our sovereign speaks through the laws of the United States. In 1918, the sovereign spoke to the prospectors in the United States through the Revenue Act of 1918. In effect the sovereign said that the prospector deserves special compensation. Through his efforts unknown natural deposits are discovered, and thus the door of taxation is open to new sources of revenue. This reward will be granted to any successful prospector by placing a limitation on the surtaxes which the prospector must pay on realizing income from the sale of any of his discovered deposits. In the Revenue Act of 1918 the limitation on surtaxes of the prospector was fixed at 20 per cent of the sales price of the property. With this benefaction the prospector was well satisfied, and again on Jan. 1, 1922, when the limitation was curtailed to 16 per cent of the sales price, the prospector had a further cause to feel elated.

In the revenue acts of 1926 and 1928, however, although Congress again limited the surtaxes of the successful prospector to 16 per cent of the sales price of his discovered property, it enacted new legislation which practically nullified any special reward to the prospector. In the revenue acts of 1926 and 1928 Congress, no doubt, fully intended to grant the same special reward to the prospectors as it had done in the prior revenue acts, but through an inadvertence the fact was not recognized that a revision of the law, appertaining to all other taxpayers, practically nullified the application of any relief which Congress may have intended to grant to prospectors.

Obviously any employee who receives higher compensation because he performs better services for his employer than others in the organization is bound to be disgruntled if his employer does not grant him a raise in salary when the salaries of all other employees are raised to the equivalent of his. Although Congress has continued to grant the same reward to prospectors, the effect of this benefaction has been nullified because of a general curtailment in the tax rates of every taxpayer in the United States.

Consequently, the special reward which was applicable in the prior revenue acts is no longer effective, because the prospector now stands practically in the same position as any other taxpayer.

The provision of the Revenue Act of 1928 in which Congress clearly expresses an intention to reward the prospector, but which fails, except in the most extraordinary cases, to effect the intended relief, is found in Section 102 (a) of the Revenue Act of 1928. This subsection of the law is quoted as follows:

"In the case of a bona fide sale of mines, oil or gas wells, or any interest therein, where the principal value of the property has been demonstrated by prospecting or exploring and discovery work done by the taxpayer, the portion of the tax imposed by Section 12 of this title attributable to such sale shall not exceed sixteen per centum of the selling price of such property or interest."

In the following discussion, proof will be established that no benefit can accrue to prospectors from this provision of the law, except in most extraordinary cases:

In the first place, no benefaction can accrue from the limitation to corporate prospectors. The limitation deals with surtax limitations. No surtaxes are levied upon corporations. Furthermore, corporate rates are 12 per cent of the net income, so that a limitation to 16 per cent of the gross sales price would be of no benefit even if it were applicable to corporate prospectors.

In the second place, no benefaction can accrue from the limitation if the prospector has held the property for more than two years. If the prospector has held the property for over a period of two years and sells it at a profit, he realizes a "capital net gain," as defined in Section 101 of the Revenue Act of 1928. Anyone who realizes "a capital net gain" can claim the limitation provided by Section 101 of the Revenue Act of 1928, which limits the total tax to 12½ per cent of the capital net gain. By the terms of the statute, "a capital net gain" is realized when capital assets are sold which have been held for more than two years. It is manifest, therefore, that in any case where the prospector holds his property for more than two years and derives a profit from the sale of the property, his income taxes, including both the normal tax and the surtax, cannot exceed 12½ per cent of the net income derived from the sale. Hence, he cannot receive any benefaction from a limitation on surtaxes providing that the surtaxes shall not exceed 16 per cent of the sales price of the property which he discovers.

In the third place, no benefaction can accrue on the limitation unless the sales price of the discovered deposit exceeds $208,500, and then only in the case where there is no expenditure for the property or its development. For proof of this assertion, see subsequent paragraphs.

In the fourth place, no benefaction can accrue from the limitation in any case where the cost of the property and its development exceeds 20 per cent of the sales price. For proof of this assertion, see subsequent paragraphs.

In the fifth place, no benefaction can accrue from the limitation unless the sales price exceeds the sum of $208,500 and the product of five times the cost of the property and its development. For proof of this assertion, see subsequent paragraphs.

In the Revenue Act of 1918 the surtax on a net income of $100,000 was $23,510. In this law the surtax was 52 per cent of the amount by which the net income exceeded $100,000 and did not exceed $150,000; 56 per cent of the amount by which the net income exceeded $150,000 and did not exceed $200,000; 60 per cent of the amount by which the net income exceeded $200,000 and did not exceed $300,000; 63 per cent of the amount by which the net income exceeded $300,000 and did not exceed $500,000; 64 per cent of the amount by which the net income exceeded $500,000 and did not exceed $1,000,000; 65 per cent of the amount by which the net income exceeded $1,000,000.

In the Revenue Act of 1928 the surtax upon net incomes of $100,000 is $11,660 (11.66 per cent); and upon net incomes in excess of $100,000, in addition, 20 per cent of such excess.

It is clear, in view of these laws, that the limitation on a prospector's surtaxes to 20 per cent of the sales price of his property under the 1918 law might afford a real benefaction; but the limitation on the prospector's surtaxes in the 1928 law to 16 per cent of the sales price seldom, if ever, affords any benefaction to the prospector.

A simple algebraic formula can be derived from which the scope and effect of this intended Congressional benefaction to the prospector can be ascertained under the 1928 law. It is important, however, to keep in mind the fact that the tax savings reflected through this formula are applicable only in cases where the prospector has held the property for a period less than two years. The point has been developed in the foregoing that, if the property has been held more than two years, no benefits accrue from the limitation.

Let S = the tax savings resulting from an application of the limitation.
a = the sales price of the property.
b = the cost of the property plus the cost of development minus depletion and depreciation allowable to the prospector prior to sale.

The tax savings, due to the limitation, equal the surtax which would be levied, except for the limitation, minus the surtax which is levied when the limitation is applied.

The surtax, except for the limitation, would be: $11,660 (surtax on a net income of $100,000) plus 20 per cent of (a—b—$100,000). The surtax under the limitation would be: 16 per cent of a. Hence, the tax savings, due to the

Schedule of Sales Prices Necessary to Effect Various Tax Savings When the Ratio of Costs to Selling Prices Varies Between Zero and 0.20

S = Tax Saving; a = Selling Price; b = Costs
$S = 0.04a - 0.20b - \$8{,}340$

$\frac{b}{a}$	S =	When S = $0 a =	When S = $1,000 a =	When S = $2,000 a =	When S = $5,000 a =	When S = $15,000 a =	When S = $25,000 a =	When S = $50,000 a =	When S = $100,000 a =
0.00	0.040a—$8,340	$208,500	$233,500	$258,500	$333,500	$583,500	$833,500	$1,458,500	$2,708,500
0.01	0.038a— 8,340	219,474	245,789	272,105	351,053	614,211	877,368	1,535,263	2,851,053
0.02	0.036a— 8,340	231,667	259,444	287,222	370,556	648,333	926,111	1,620,556	3,009,444
0.03	0.034a— 8,340	245,294	274,706	304,118	392,353	686,471	980,588	1,715,882	3,186,471
0.04	0.032a— 8,340	260,625	291,875	323,125	416,875	729,375	1,041,875	1,823,125	3,385,625
0.05	0.030a— 8,340	278,000	311,333	344,667	444,667	778,000	1,111,333	1,944,667	3,611,333
0.06	0.028a— 8,340	297,857	333,571	369,286	476,429	833,571	1,190,714	2,083,571	3,869,286
0.07	0.026a— 8,340	320,769	359,231	397,692	513,077	897,692	1,282,308	2,243,846	4,166,923
0.08	0.024a— 8,340	347,500	389,167	430,833	555,833	972,500	1,389,167	2,430,833	4,514,167
0.09	0.022a— 8,340	379,091	424,545	470,000	606,364	1,060,609	1,515,455	2,651,818	4,924,545
0.10	0.020a— 8,340	417,000	467,000	517,000	667,000	1,167,000	1,667,000	2,917,000	5,417,000
0.11	0.018a— 8,340	463,333	518,889	574,444	741,111	1,296,667	1,852,222	3,241,111	6,018,889
0.12	0.016a— 8,340	521,250	583,750	646,250	833,750	1,458,750	2,083,750	3,646,250	6,771,250
0.13	0.014a— 8,340	595,714	667,143	738,571	952,857	1,667,143	2,381,429	4,167,143	7,738,571
0.14	0.012a— 8,340	695,000	778,333	861,667	1,111,667	1,945,000	2,778,333	4,861,667	9,028,333
0.15	0.010a— 8,340	834,000	934,000	1,034,000	1,334,000	2,334,000	3,334,000	5,834,000	10,834,000
0.16	0.008a— 8,340	1,042,500	1,167,500	1,292,500	1,667,500	2,917,500	4,167,500	7,292,500	13,542,500
0.17	0.006a— 8,340	1,390,000	1,556,667	1,723,333	2,223,333	3,890,000	5,556,667	9,723,333	18,056,667
0.18	0.004a— 8,340	2,085,000	2,335,000	2,585,002	3,335,000	5,835,000	8,335,000	14,585,000	27,085,000
0.19	0.002a— 8,340	4,170,000	4,670,000	5,170,000	6,670,000	11,670,000	16,670,000	29,170,000	54,170,000
0.20	0.000a— 8,340	∞	∞	∞	∞	∞	∞	∞	∞

limitation, may be expressed by the following formula:

$S = \$11{,}660$ plus 0.20 (a—b—$\$100{,}000$) —.16$a$.

Reducing the equation:

$S = .04a - .20b - \$8{,}340$.

From the foregoing formula it is clear that no tax savings result unless the sales price exceeds $208,500. In the formula, when $S = O$ and $b = O$, $a = \$208{,}500$.

From the formula it is also clear that there is no tax saving in any case where the cost equals or exceeds 20 per cent of the sales price. When $\frac{b}{-} = .20$, $S =$ a negative quantity.

From the foregoing formula it is clear that there is no tax saving unless the sales price exceeds the sum of $208,500 and the product of five times the cost. When $S = O$, $a = 5b$ plus $208,500.

The schedule in the table shows the sales prices necessary to effect various tax savings when the ratio of costs to selling prices varies between zero and .20.

The accompanying graph shows curves plotted for various tax savings between ordinates, which represent sales prices, and abscissæ, which represent the ratios of costs to selling prices.

The foregoing proves conclusively that the benefaction which Congress clearly intended to grant to prospectors is of no benefit to the prospectors except in most extraordinary cases. Congress manifestly inadvertently overlooked an adjustment in the limitation provisions which affected the prospectors' taxes when it granted general reductions in tax rates to all other taxpayers. Consequently, the special benefaction intended for the prospectors has been practically nullified.

In conclusion it is contended that:

1. Section 102 (a) of the Revenue Act of 1928 is conclusive evidence of a Congressional intent to award a special benefaction by way of tax relief to prospectors who add wealth to the nation's resources which had previously been unknown to exist.

2. This intended benefaction is seldom, if ever, a source of relief to a successful prospector.

3. Section 102 (a) of the Revenue Act of 1928 should be amended so that the law will provide the tax relief which Congress obviously intended to grant.

4. A prospector should be exempt from any surtax on net income derived from the sale of deposits which he has discovered.

5. In cases where agents of a corporation serve their employers as prospectors, and discover mineral or oil and gas deposits for their principals, the tax rate on net income derived by the corporation from the sale of the discovered deposit should be lower than the normal tax rate of 12 per cent.

A Remarkable Rescue

Arnold Gustafson

Mining Engineer, Crosby, Minn.

AT ABOUT 2:15 o'clock Tuesday afternoon, Dec. 10, 1929, a drift caved in on the 366-ft. level of the Croft mine, at Crosby, Minn., a property operated by Pickands, Mather & Company. One miner escaped with his life on account of his having left the face of the drift a few seconds before. The other miner working in the drift was standing on a staging, timbering. About 20 ft. of the drift filled up tight except for one small corner against the breast. This opening was just large enough to hold a man, and into this was thrown the entombed miner. He was thrown into a cramped position with one knee close to his chin and the foot of the other leg pinned under some poles and plank. His body was crouched over.

THE DRIFT was 10x11 ft. and extended 54 ft. east of Raise 414. The cave-in occurred in a narrow part of the orebody where the ore is only 15 ft. wide. In mining operations the ore was being extracted by top-slicing. The entombed miner's partner notified the bosses immediately, and men were rushed to the place to prop the sets so as to prevent more of the drift from caving. Lining sets were also placed and the cave was spilled so as to prevent the movement of more rock into the drift.

A small 2x3 dog drift was started about 3 ft. above the bottom of the caved drift on the hanging-wall side. The dog drift was started this high so as not to undercut a large timber which was resting on the hanging wall and supporting part of the cave. On account of the danger of additional rock and timber caving in on the rescue crew, it was necessary to drive a small drift. Blasting was out of the question and moiling had to be resorted to. In average iron ore, to make good progress with a pick would have been easy, but even with sharp moils and a jackhammer it was impossible to advance more than a few inches an hour against the extremely hard blue steel ore.

A short time after the cave-in the entombed man could be heard to answer to his name. A drill hole to carry air to the man was started from a drift 17 ft., on the angle of the orebody below the cave-in. This hole was drilled 12 ft., and then it was decided best not to continue the hole, because the man was still alive and undoubtedly getting air through the cave along the hanging wall. Besides, there was a possibility of running the drill into the man.

After about 26 hours of tedious moiling in a crouched position the small dog drift was extended to the end of the caved drift. Fresh men were always available, but only one man could work at a time. Lying in a crouched position trying to hold a bouncing jackhammer against a face of ore as hard as steel was very trying on the strongest of men. The last five feet of the dog drift was worked down to the bottom of the cave, so that the men were almost standing on their heads. In spite of the fact that the men were changed at short intervals, they were wringing wet when relieved. In addition to the physical handicaps there was a mental strain caused by the entombed man's pleadings to be released. Although he said he was not suffering from physical pain, the darkness and possibility of death at any moment caused him to become irrational at times.

After reaching the man on Wednesday afternoon a stimulant was passed to him in a bottle on the end of a stick. He drank it and passed the bottle back. A few hours later he was given his first smoke. After this first stimulant the man refused to take anything except water and did not care for food in any form.

WHEN the dog-hole drift alongside of the cave was completed to the breast, and the entombed man was partly visible through a small hole, it was found that a large loose rock was rather precariously supported only a few inches above his head. This new hazard, which might cause instant death if disturbed, made necessary some revision of the original plan of rescue.

At about 10 o'clock Wednesday night the situation looked none too promising. A conference of mine officials, foremen, bosses, engineer, and company and county safety inspectors was called. It was decided to widen out the original dog drift alongside of the cave to make ample working room, and to start moiling a raise from the sublevel below, the raise to be landed a few feet east of the breast against which the entombed man was lying; then to drift to the breast from this raise a few feet below the elevation of the caved drift. Either operation would take several days, but it was now possible to feed the entombed miner. A raise had been started soon after the cave-in occurred, but the man begged to have the moiling stopped because the vibration was shaking down material which was suffocating him. The possibility of going

under the cave from the side of the dog drift was also considered, but, owing to the additional danger of disturbing the cave and causing it to move, it was thought best not to subject the men to this added hazard.

A GANG of miners was started at moiling out a raise as planned at the conference. A jackhammer was used instead of a stoping machine, because of the lighter blow it strikes. The entombed man made no objection. The plan of enlarging the dog drift close to the breast met with little enthusiasm from the miners, who showed plainly that working so close to the entombed, irrational man was nerve-racking to the men with the best of nerves. Also, the situation was aggravated by the possibility of the overhanging chunk's falling at any moment in the presence of the crew and crushing the life out of the entombed man. Some of the miners even stated that they did not care to continue to work as planned. However, several suggested another means of attack in line with the possibility of going under the cave. After due consideration, the miners were allowed to start with their plan and the possibilities of the plan were carefully considered and its execution was watched closely. It was obvious from the start that the plan set forth by the miners, although subjecting them to more danger, was by far the best suggested for a speedy release of the entombed man. The men worked cautiously and enthusiastically at the new plan.

The posts on the hanging side were all standing. About 8 ft. back from the breast a large timber 10 ft. long was lying partly exposed in the dog drift. One end was resting on very solid ore in the dog drift; the other was resting on the bottom of the caved drift and inclined toward the breast. The men decided to sink in the loose ore of the cave between this inclined timber and the vertical post 10 ft. from the breast. After removing all the loose dirt to the bottom of the dog drift, which was about 3 ft., a hole just large enough for a man was opened up under this inclined timber in the direction of the entombed man. Loose dirt and lagging were removed from the cave and several poles were sawed off. Wherever possible blocking and sprag were placed to secure the opening.

A STATION plank but a few feet from the entombed man and only about 10 in. above the bottom of the drift lay directly across the path of the opening. This was supporting part of the cave and could not be disturbed. The man had to be taken under this plank. It was now possible to reach under this plank and remove some of the loose material about the entombed man. When he was rational he managed to help a little himself. A rope was passed under this plank and the entombed miner tied the rope around his waist. He was pulled a few feet, enough to straighten him out, and then it was found that one foot was caught among some timber.

The upper part of the man's body had been pulled underneath the plank mentioned in the foregoing, and it was now necessary for one man to lie on the entombed man and try to remove enough ore below the man's foot to allow the foot to drop down and be released. As the foot was on the far side of the plank, which could not be cut for fear of moving the cave, to release the foot was very difficult. A special hook for scratching under the foot and removing the ore, had to be contrived. About four hours of labor was required to release the foot. After the entombed man's foot was released he was pulled to safety through the dog hole drift, placed on a stretcher, looked over underground by the doctor, and placed in the hospital about fifteen minutes after he was released from the cave. The man reached surface at 11:40 a.m., Thursday, 45 hours after the accident.

Credit for this rather remarkable rescue is due to the miners, who worked faithfully to the limit of their endurance both mentally and physically, in the face of death from another rush of rock and timber.

Geology and Science

YOU never heard of Gold being discovered in this part of Ill., did you. No. Why? Because nobody ever thought to look. . . . You know what quarts is . . . Not quarts of milk like you bone heads mean, but quarts like Gold comes in. Whairever there is a certain kind of clay there has got to be that kind of quarts and whereever there is a certain kind of quarts there has got to be gold. . . .

Well, that kind of clay with that kind of quarts in it with nuggits of gold stuck into it like raisens in a cooky is made and hid out by Gee-ology. And what is made by Gee-ology and hid by Gee-ollogy it takes Gee-ologey to find again and that is where Science comes in. Science tells you where Geolligy has hid things. . . .

This has got to be done Leegal right from the start, says Squint, or there would be trouble later. This clame has got to be staked off.

My idea says Mull would be to get the gold first, if we stake it off first somebody might see the stakes, we better get the gold first and Stake it off afterwards.

I am ashamed of you Mull, says Squint. Don't you want this done honest?

I had not thought of that and I was mighty g'ad Squint's conshince was on the job. And then I says to Squint it seems to me even if we do stake off a claim all this Gold oughto belong by rights to whatever farmer owns this land.

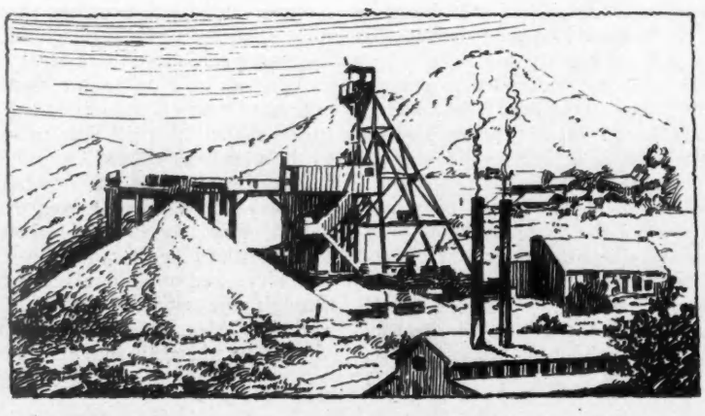
Dont be a dum bell, says Squint, aint you ever heard of treasure trove?

What does it mean, says Mull.

It is one of those unwritten laws you read about that is higher than all other laws, says Squint, and it means that findings is keepings.

Even if it is Leegal I said, it don't sound right to me not to give any of it to the farmer that owns this land.

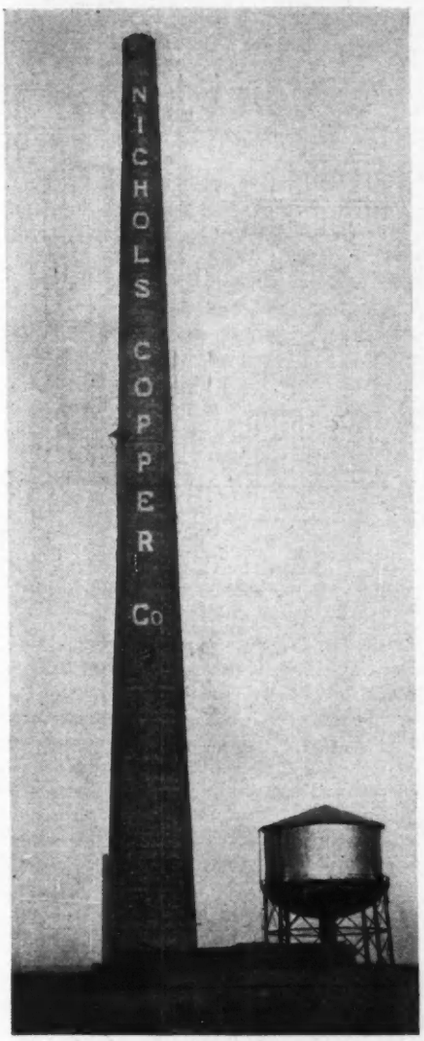
That is because you dum bells don't know anything about riptarian rights says Squint, showing off again. Riptarian rights is when treasure trove lays along a crick or river bank, maybe some of it has washed down stream from above, and all the way up and down the stream it is like that, and for all we know a lot of the Gold that leegally belongs to us has been washed down stream. It is like fish, these bullheads don't belong to this farmer just because they were caught on his land, they are leegally entitled to swim up and down stream, and they belong to whoever is wherever they are caught, and it is the same way with this Gold.
—From "The Diary of Freckles Watson," by Don Marquis, in *Scribners.*



Furnace and Casting Equipment of the New Nichols Refinery

Edward H. Robie

Associate Editor



The long and short of it—the 600,000-gal. water tank is dwarfed, in height at least, by the 410 ft. stack

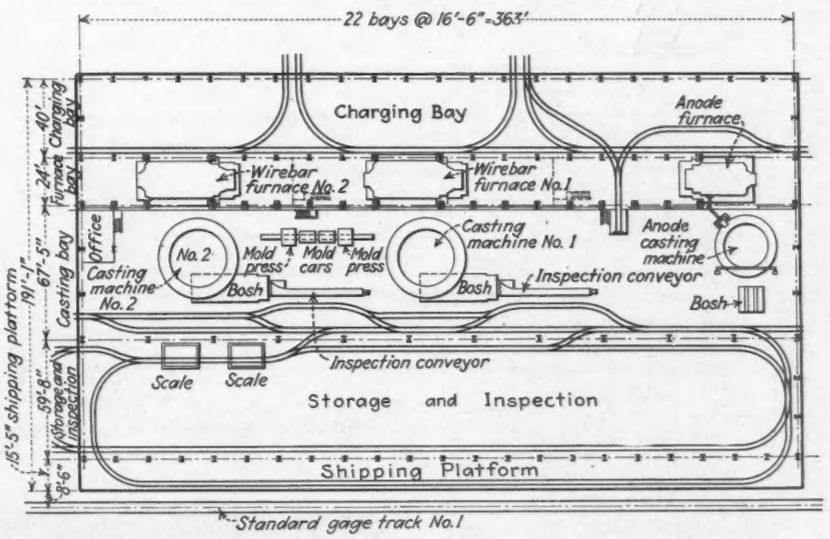
▼

A GENERAL *description of the new refinery of the Nichols Copper Company, at El Paso, Tex., appeared in the Jan. 9 issue of Engineering and Mining Journal. Complementary to that is the accompanying short description of the equipment in the furnace department, with drawings showing a plan of that department, details of the furnaces, and the general design of the casting wheel.*

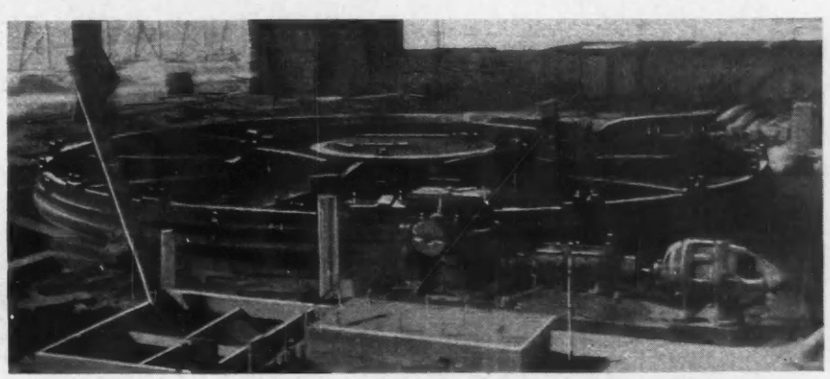
▲

ESSENTIALLY, the furnace equipment of the new El Paso refinery of Nichols Copper consists of two 250-ton cathode melting furnaces and one anode scrap melting furnace. All are gas-fired, with appropriate charging equipment, two casting wheels for the production of commercial shapes, and one casting wheel for anodes made from scrap copper. Ample space is provided in the building, not only for this equipment but for such additions as may be necessary, and for storage and loading. The entire floor of the building is paved with reinforced concrete, encouraging cleanly operation and facilitating moving the metal about.

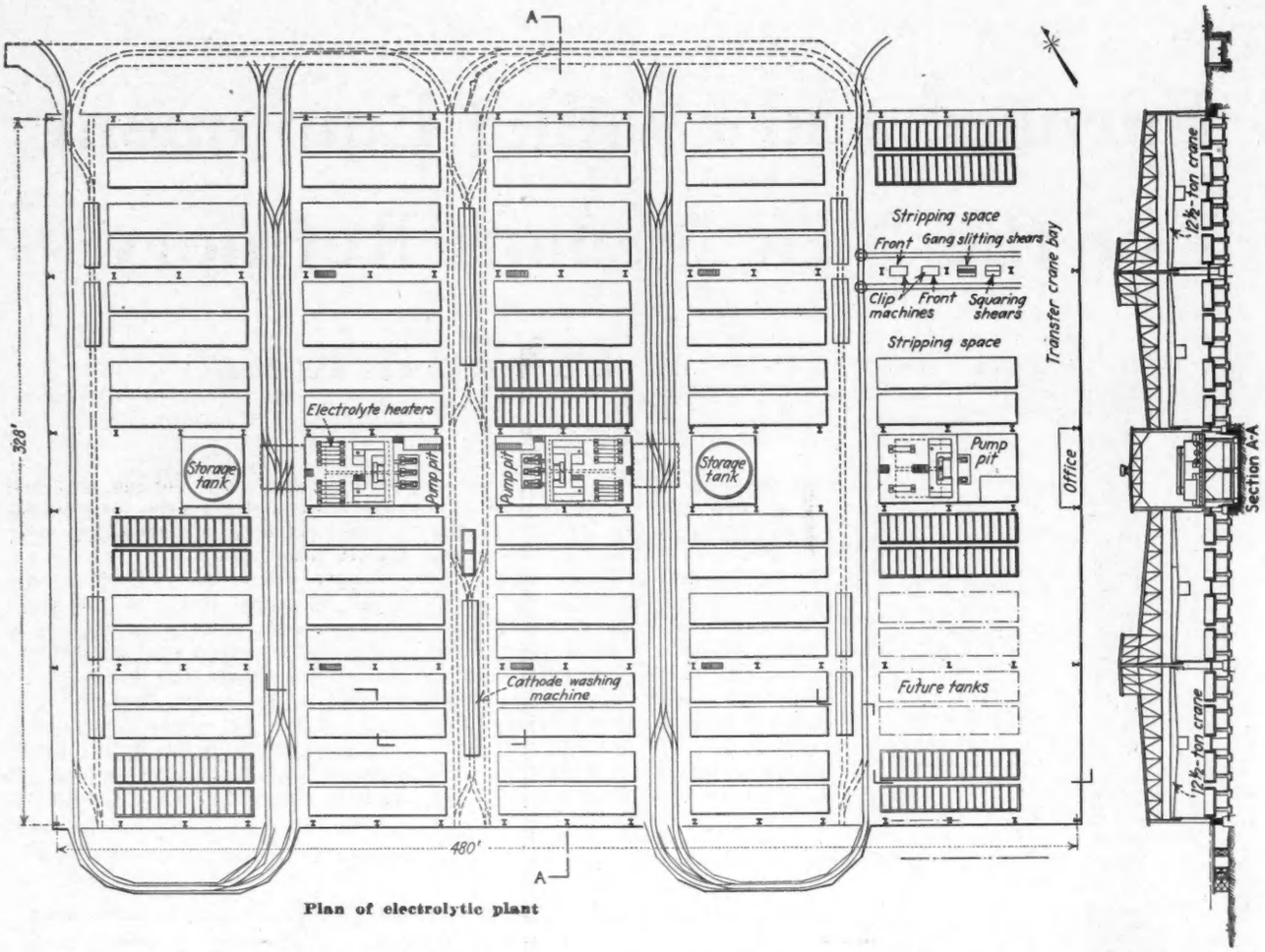
Copper enters the building on the upper operating level, at the same elevation as the cellar of the electrolytic department, on which level the furnaces are erected. Seven feet below this is the casting and loading floor, with the tracks at the far side of the building taking advantage of the further gentle slope of the land, so that the floors of the cars are on the level of the loading



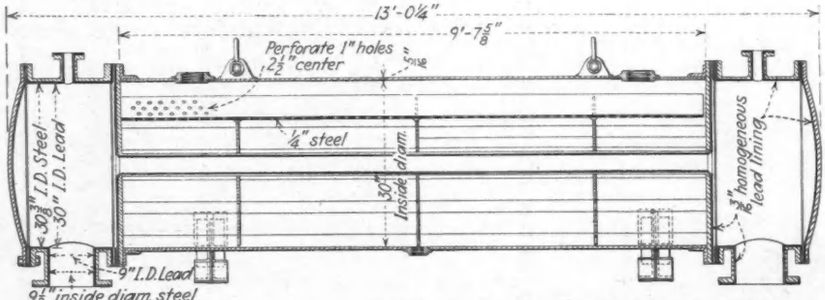
Plan of the refinery building, showing arrangement of the various units



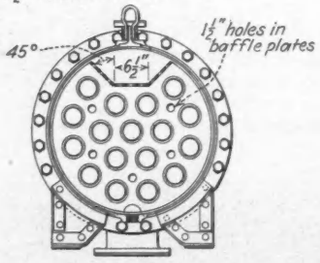
One of the casting machines as it appeared while being erected



Plan of electrolytic plant



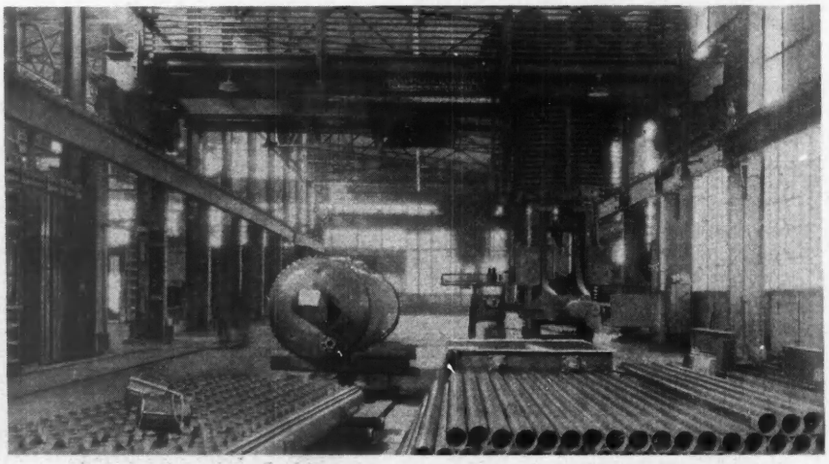
Cross-section showing details of construction of electrolyte heater



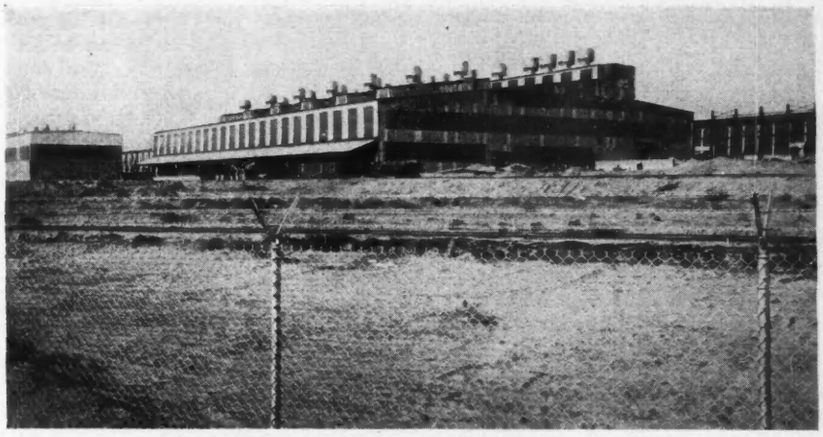
platform without the necessity of excavating.

Cathodes are shunted to the most convenient position and are then picked up by one of two charging cranes of the most modern design, each weighing about 67 tons. The construction of the cathode melting furnaces is made clear by the accompanying sketch. The iron plates on the bottom are supported on brick; then come two layers of clay brick, one layer of 9-in. silica brick, and one layer of 15-in. silica brick. This brick bottom is considered superior to a fused bottom of copper silicate, as less harm is occasioned by excessive heat. At the Baltimore refinery, I believe, thermocouples were once installed in the bottom of the furnace by which the operators could judge when the temperature was becoming dangerously high.

One tap hole is provided, to which a sloping slot is left in the silica brick floor. The side walls are of magnesite



Charging crane, with waste-heat boiler equipment in foreground



Note the ventilators provided for the furnace building, and the excellent window area. Eight miles of the non-scalable fence in the foreground protects the plant from such light-fingered gentry as may hover in the offing.

brick to a point above the metal line. Above that, silica brick are used, these also being employed for the arch. The skewback is of cast iron. Heavy springs are provided to allow for lateral expansion and contraction of the furnace, these springs being set against the buckstays along the bottom of the furnace on each side, and on one side of the tierods along the top. The springs are adjusted after the furnace is once thorougly heated, and thereafter expansion and contraction are taken care of automatically.

Each furnace is equipped with a 600-hp. straight-tube type of waste-heat boiler, the steam from which is used for heating the electrolyte and other process work in the plant. A fan provides induced draft, an unusual installation modeled after practice that has proved successful in the new Oolen refinery in Belgium. Boiler-feed water is supplied from the deep well on the property, after treatment in a cold-process softener.

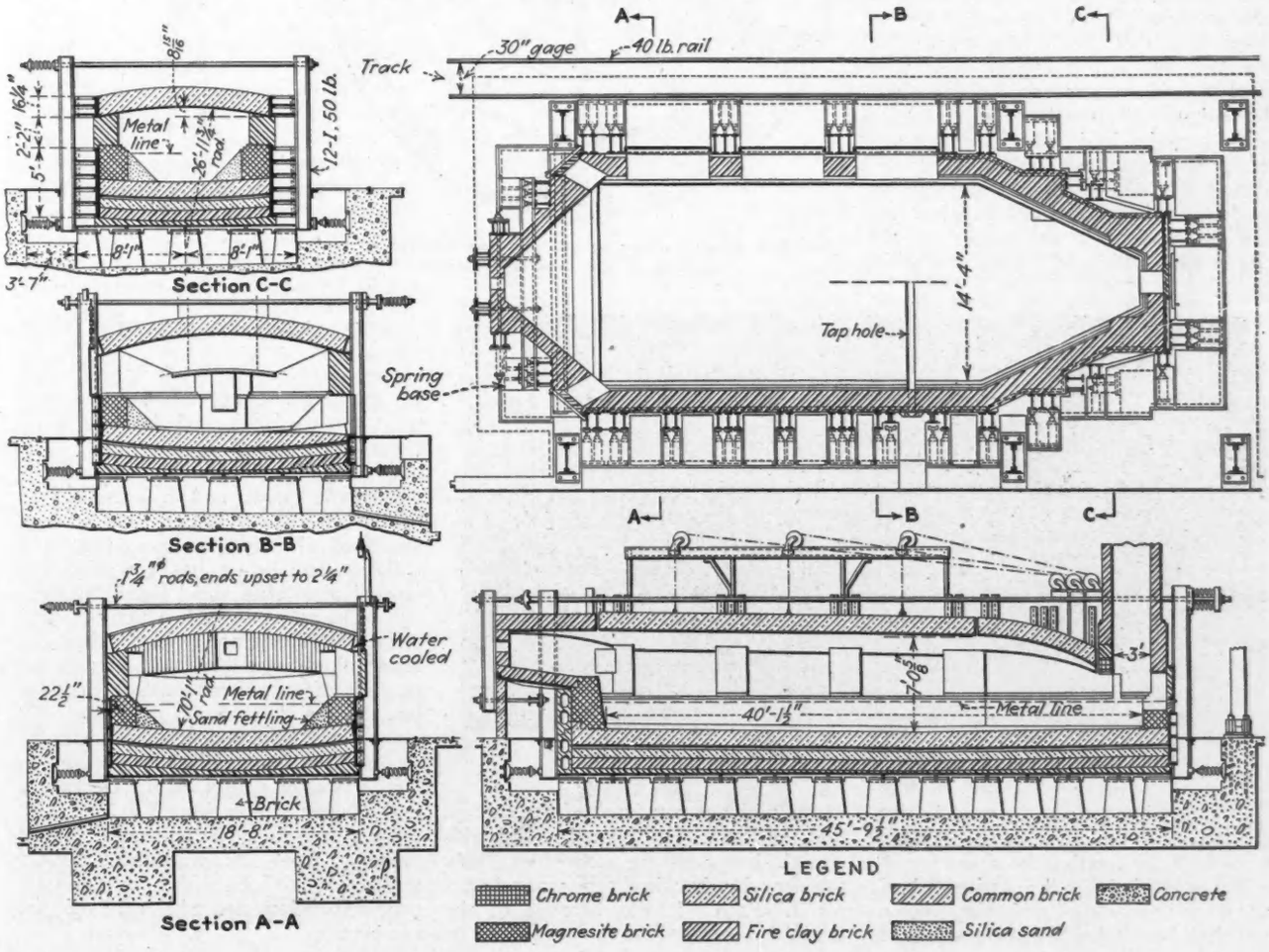
The furnace installation here is unusual in two particulars, one being the use of natural gas for firing, rather than oil or pulverized coal as used at most other refineries; and the other, the provision for preheating the air used for combustion, to secure an economy in fuel.

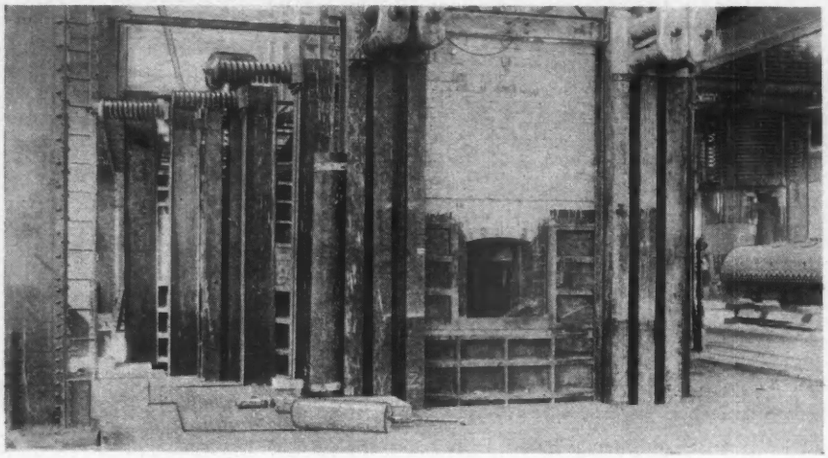
Natural-gas firing for refining furnaces is not unique, for the Great Falls refinery of Anaconda has been employing this fuel for almost two years. The difficulties encountered at Great Falls were largely in connection with the development of a proper burner, and it is hoped that this question is now practically solved.

The gas recently piped into El Paso comes from a New Mexican field about 150 miles away, under 150-lb. pressure. It varies in B.t.u. content from 1,059 to 1,066, fortunately contains no sulphur, and, as a fuel, can be substituted for oil, heat unit for heat unit. Should there be any failure in gas supply, however, provision is made for oil-firing, and there is a 300,000-gal. oil storage tank erected in the yard.

The preheater for the furnace air bleeds a portion of the hot gases—at about 1,700 deg. F., it is expected—from above the first bank of boiler

Details of construction of the cathode melting furnaces

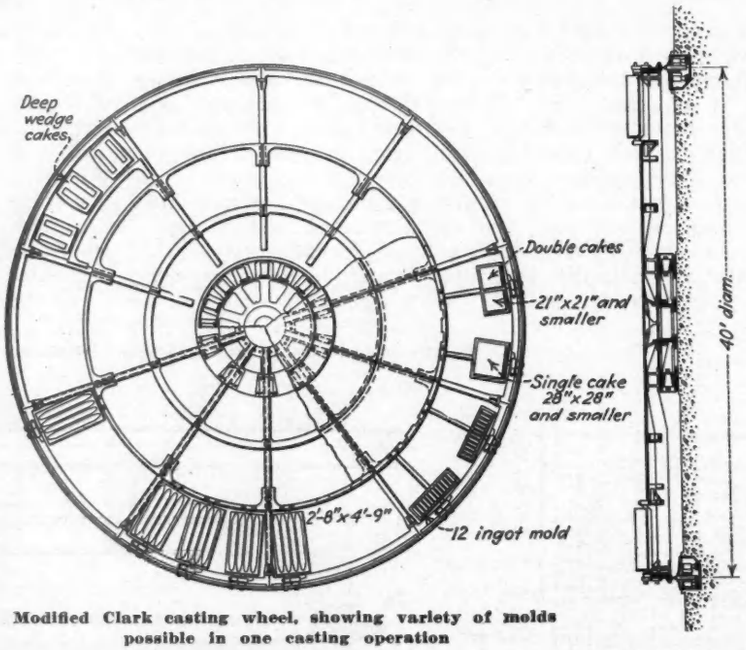




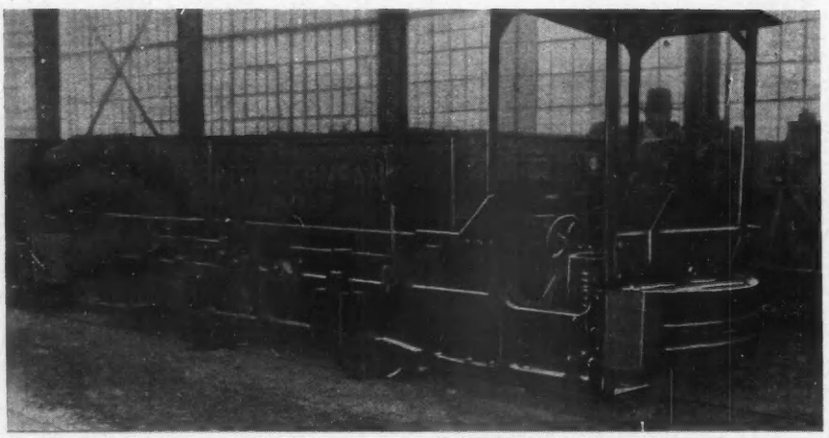
Refining furnace, showing spring-backed buckstays

tubes. The air for combustion will be drawn through carborundum tubes on the other side of which the hot gases circulate. By this means it is expected to raise the air temperature to between 800 and 1,200 deg. F. and to make a fuel saving of from 12 to 20 per cent. There being no use for the waste heat except for heating the electrolyte and for evaporation in making bluestone, and the amount available being amply sufficient for these purposes, the use of a portion for preheating the air would seem to be a wise experiment. In selecting the material for the construction of the preheater it was necessary to find something that would not only stand the heat but that would not react with copper oxide. It is expected that carborundum will meet the requirements.

Goosenecks lead from the furnaces to a heat-insulated balloon flue, and thence to a 410-ft. stack, which carries the name of the company in white tile for the benefit of passengers on the Southern Pacific and Texas & Pacific.



Modified Clark casting wheel, showing variety of molds possible in one casting operation



Type of storage-battery locomotive used about the plant

Cottrell equipment will be used in connection with the doré furnace that is to be built for treating the slime.

The modified Clark casting wheels are 40 ft. in diameter, and every precaution has been taken to avoid vibration. Those who are cognizant of the success that the Laurel Hill plant has had with straight-line casting machines may wonder why the wheel type was selected for El Paso. It was because of the flexibility secured in the casting of various shapes, for, with the design used, molds of various kinds can be set in different parts of the wheel, so that wirebars, ingots, and cakes, for example, can be made in the ratio desired, in one operation.

Special provision has been made for the quick determination of the oxygen content of the refined copper, in a near-by control room, so that the furnace operator can get the oxygen content of his charge in a very few minutes while casting. A miniature wirebar also can be rolled quickly and drawn into wire for the purpose of a conductivity test.

The cast copper drops in a bosh, supplied with fresh cooling water, from which an inclined conveyor carries it to a horizontal inspection conveyor and delivers on to an inspection table. From here, an air hoist carries the copper to storage or loads it on to cars for shipment. Storage-battery locomotives are used for such hauling as is necessary.

On page 74 is shown a plan of the electrolytic plant and a cross-section of the electrolyte heater, which were described briefly in my preceding article. The heater has a welded and riveted steel shell, lead lined throughout. The tubes through which the electrolyte circulates are expanded into the crown sheets at either end. Circulation in each of the fifteen heaters that are provided will amount to about 200 g.p.m., and the temperature will be raised from about 125 to 143 deg. F. The hydrostatic head on the electrolyte in the heater will be from 2 to 3 ft., with gravity feed through the heater. Steam pressure from the waste-heat boilers will be about 15 lb., with a vacuum tank provided below to take care of the condensate.

Chrome ore lodges on Red Mountain, Kenai Peninsula, Alaska, looking northwest from discovery monument. Note man 500 ft. away in middle distance

Domestic Chrome Mining

Alaskan Deposits Promise Ore of Commercial Grade

W. P. Lass

Santa Cruz, Calif.

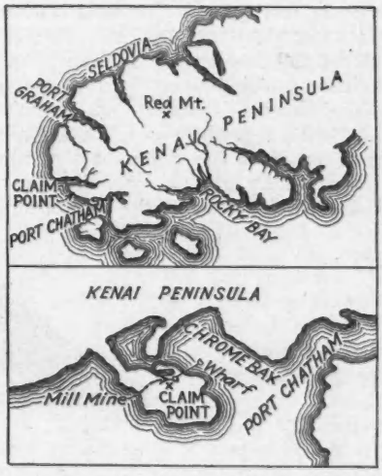
RAPID INCREASE in the use and consumption of chromium in recent years, estimated to be at the rate of 25 per cent annually in the United States alone, logically makes the location and size of chromite deposits a matter of interest and importance. Recent adaptation of the metal in the manufacture of motor cars alone opens up a market the size of which can hardly be estimated. At present industries in the United States are relying upon foreign supplies for 100 per cent of their needs, yet in this country occur large deposits of chromite which are untouched although within easy and inexpensive reach of the American market. This fact may be of great importance to this country, inasmuch as the political and commercial control of the chrome ore supply now rests largely with England.

In Alaska, deposits of chromite were put on the map during the World War as a result of the request of the government, chrome being a necessity in the production of munitions. With the cessation of the war this demand ceased. However, it has since developed that this mineral has met with a decided and increasing demand in industry, which is now calling for a larger amount than was used at any time during the war. More chromium is used in the United States today than in all other countries combined. To meet this increasing demand our industries are depending upon foreign resources. Little if any attention is being given to the large deposits of ore uncovered in 1918.

Chromite was found on Kenai Peninsula, Alaska, years prior to the World War, and during the war shipments were made from an ocean reef at Claim Point, the extreme western end of Kenai Peninsula. Another area on the same peninsula where deposits of chromite have in years past been known and at times located is at Red Mountain. It is about 15 miles inland from Claim Point, but only 5 or 7 miles from various salt-water bays. Although prior to 1918 the known deposits of this region were of limited grade and extent, an analysis made by Bogardus Laboratories, of Seattle, and published in the U. S. Geological Survey's Bulletin 587, credits this region with ore assaying 57 per cent Cr_2O_3. While in search of this particular ore engineers discovered an extensive body of continuous high-grade chromite. Prof. A. C. Gill, of Cornell University, in reporting on the characteristics of this deposit says:[1]

"The outstanding peculiarity of the chromite bodies of Kenai Peninsula is their continuity for considerable distances in bands or layers, for such bodies elsewhere are generally scattered and pockety. The longest orebody observed in the Red Mountain district extends for a distance of more than 600 ft. as a deposit ranging in width from 6 to 11 ft., and it continues northward for at least 500 ft. farther in the form of separate stringers, some of which are as much as one foot wide. It is at an altitude of about 2,600 ft. on a sort of ridge-ribbed plateau in the east angle of the main valley. It strikes North 8 deg. West and dips 60-70 deg. West.

Sketch map showing situation of Claim Point and Red Mountain, both on Kenai Peninsula, where chrome ore occurs



[1] "Chromite of Kenai Peninsula, Alaska." U. S. Geological Survey Bulletin No. 742, published in 1922.

Chrome gully on Red Mountain, Kenai Peninsula. Note figure of man 500 ft. away in middle distance.

"A section at the discovery monument was measured as follows:

	Ft.	In.
Dark ore, mostly of shipping grade containing 16 in. of silicate rock in five bands, the thickest of which is 6 in.	10	7
Rock	1	2
Black ore	..	4
Rock	..	5
Ore	..	5
Total thickness (2 ft. 11 in. waste)	12	11

"For 500 ft. along the strike northward from the discovery monument the ore is in a trench or gully, doubtless excavated by glacial action in the less resistant chromite. In spite of abundant loose material, the exposures are numerous enough to leave no doubt of the continuity of the ore for the whole distance, probably with only gradual variation in cross-section. At 500 ft. from the monument the section is as follows:

	Ft.	In.
50 per cent ore	1	2
Rock	2	2
42 per cent ore	..	11
Rock	..	6
40 per cent ore	1	5
10 per cent ore	..	8
Mostly dunite	..	10
20 per cent ore	1	10
Total thickness (3 ft. 6 in. waste)	9	6

"For the next 200 ft. northward on the ore the stringers get farther apart, but one rich band maintains a thickness of 6 to 14 in. for a distance of not less than 500 ft. South of the discovery monument the chromite can be traced 130 ft., to a point where it is reduced to a thickness of 18 in. of good ore."

Chemical analysis of samples taken from this ledge indicates that a large proportion of what might be called shipping ore contains in excess of 50 per cent Cr_2O_3. Professor Gill estimates that the deposit contains 90,000 tons of shipping ore and 80,000 of lower-grade ore, from which a possible 32,000 tons of concentrates may be obtained, or a total of 122,000 tons of high-grade ore from this deposit.

The map shows the proximity of the Red Mountain district to salt-water ports.

At Claim Point the largest mass of chromite was first located and uncovered in 1918. This deposit is very different in character from the stratified leads at Red Mountain. It is not less than 40 ft. wide and 200 ft. long and may have been part of an original chromite lead traceable for more than 1,500 ft. and from which the leads have, as it were, telescoped each other and united the chromite to form a solid mass of rich ore. The deposit has a vertical dip and strikes North 50 deg. East. It is exposed along the timbered slope of the hill looking down into Chrome Bay and is at an elevation of 150 ft. and about 500 ft. back from the beach. It was so much more attractive than any of the deposits previously known at Claim Point that operations were immediately begun to get this ore to market.

A short tramway was built to convey the ore to the beach, where ore bins were built for storing the high-grade ore and a 20-stamp mill was provided for concentrating that of lower grade. From the mill a wharf was built out to the deep water of Chrome Bay, on which was laid a tramway to transport the ore to steamers. The termination of the war put an end to all these activities.

This deposit at Claim Point, Professor Gill estimates, contains 10,000 tons of shipping ore and 60,000 tons of concentrating ore. At the time the estimate was made the orebody had been only partly uncovered. As a result of further stripping it is believed that a company prepared to mine and mill all the exposed ore at Claim Point might reasonably expect to recover four or five times this amount of chromite.

A chemical analysis of a 500-lb. sample taken from the dump at the mine was made by the U. S. Bureau of Mines. It represents the run-of-mine ore with the high grade or shipping ore removed. The sample was equivalent to what would be milling ore, and analyzed as follows:

	Per Cent
Chromium oxide Cr_2O_3	24.64
Ferrous oxide FeO	18.72
Silica SiO_2	22.57
Magnesium oxide MgO	32.63
Aluminum oxide, Al_2O_3	0.91
Undetermined	0.53
	100.00

Concentration tests made in the experimental plant of the Alaska Gold Mines Company near Juneau, Alaska, using a small amalgam barrel for grinding and a Garfield concentrating table produced a 50 per cent Cr_2O_3 concentrate. Three mill tests made by them gave an average concentrate of 50 per cent Cr_2O_3. The recovery obtained was 70.9 per cent. The iron content is from 10 to 14 per cent.

The cost of transportation of the ore from Claim Point to Seattle via regular line Alaska steamers is $4 per ton. Because of the proximity of mine and mill to the dock the usual inland transportation charges to railroad sidings and wharfs are eliminated. This means that the $4 steamer rate constitutes all transportation costs from the chrome property to Puget Sound ports. In view of the large size of the deposit, making open-pit mining practicable, and of its nearness to steamers, it is estimated that 50,000 tons of chromite, 45 to 55 per cent Cr_2O_3 in the form of lump ore and concentrate, may be delivered f.o.b. cars Puget Sound ports tor not more than $15 per ton.

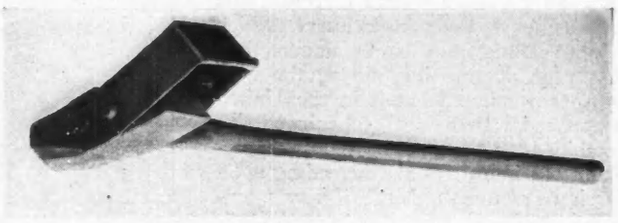
■

Safety Guard for Cold Chisel

IN MANY instances the cheapest and quickest way to remove a bolt is to knock off the head, writes R. E. Marks in *American Machinist*. However, this can be dangerous if the head is allowed to fly wherever the force of the sledge behind the chisel sends it.

To prevent an accident of this kind, a safety cold chisel, with a loosely hinged cover, may be used, pictured herewith. The guard is a shallow box, made of sheet metal and held to the flogging chisel. By dropping the guard over the bolt, the head is prevented from flying when the chisel cuts it off.

The same device can be used when cutting off rivet heads. The guard is off the vertical when the chisel is against the bolt head. The blow of the hammer knocks it over the head.



Safety guard for cold chisel

Roasting with Sulphuric Acid Increases Zinc Recovery

B. H. Strom

FORMATION of ferrites in the roasting of zinc concentrates is a difficulty which the zinc metallurgist has not yet been able to overcome. Zinc ferrite is generally considered to have the formula $ZnOFe_2O_3$, one part of zinc in combination with 1.7 parts of iron. This compound, insoluble in dilute sulphuric acid at the temperature used in normal leaching operations, is formed by the reaction between the oxides of zinc and iron, a reaction which takes place with increasing speed as the roasting temperature rises above 650 deg. C. Another governing factor is the physical nature of the concentrate. Where there is an intimate mixture of the crystals of the zinc and iron sulphides, as in marmatite, the reaction between the oxides is greatly facilitated. With the present methods of roasting, formation of some ferrite is unavoidable, if a satisfactory removal of sulphur is to be effected.

Modern methods of selective flotation have accomplished much in lowering the iron content of the concentrates —the main problem; but most zinc concentrates still contain about 5 per cent iron, capable of tying up about an equivalent amount of zinc, which represents a direct loss in the leaching operation. In addition to this, the increased zinc content of the residue makes the subsequent furnace treatment for recovery of lead, silver, and gold more difficult and expensive.

Anaconda Copper Mining Company has developed a process in its electrolytic zinc plant at Anaconda whereby the insoluble zinc in the residue is rendered water soluble and is largely recovered. Briefly, the method involves treatment of the residue with strong sulphuric acid at high temperature, whereby the ferrites are decomposed according to the following equation:

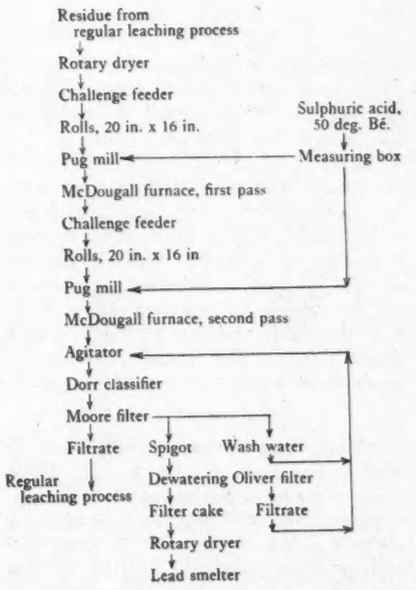
$$ZnOFe_2O_3 + 4H_2SO_4 = ZnSO_4 + Fe_2(SO_4)_3 + 4H_2O$$

Both sulphates are water soluble. To dissolve a large amount of ferric sulphate would, however, not be desirable, as such a solution cannot be electrolyzed without removal of the iron, which is a difficult step. Fortunately, ferric sulphate is decomposed at a comparatively low temperature, decomposition taking place rapidly between 500 and 600 deg. C., whereas zinc sulphate does not break up to any appreciable extent below 700 deg. C. By keeping below this temperature, therefore, zinc sulphate remains practically unchanged, but the ferric sulphate is decomposed in the following manner:

$$Fe_2(SO_4)_3 = Fe_2O_3 + 3SO_3$$

Ferric oxide being highly insoluble, a zinc sulphate solution free from iron may be obtained by leaching the residue with water.

A graphic illustration of the operation is given in the accompanying flow sheet of the separate unit of the plant



where the residue from the regular leaching operation is treated. This residue, which formerly was shipped to a lead smelter, is dried in an oil-fired Ruggles rotary dryer, where the moisture content is reduced to between 10 and 14 per cent. The dryer discharge passes through a Challenge feeder to a set of rolls, where lumps formed during the drying process are broken up, and is then transferred to a pug mill, where the residue is mixed with sulphuric acid from the company's local acid plant, added through a measuring box. The normal amount of acid required for the decomposition of the ferrites is about 35 lb. of 50 deg. Bé. acid for each per cent of zinc contained in the residue. This amount of acid cannot be added in one step, as the mixture would be too fluid. Two additions are therefore necessary, with a preliminary roast after the first addition, the purpose of which is principally to dry the mixture to allow the further addition of acid. In the first step, as much acid is added as is possible without gumming up the pug mill, depending largely upon the moisture content of the residue.

The acid-residue mixture is roasted in a McDougall furnace having oil burners on the third, fifth, and sixth hearths. As the residue passes through the furnace, the excess moisture is expelled, and the free acid is neutralized by the zinc and iron oxides. Very little decomposition of the ferric sulphate takes place in this preliminary operation, however. From the furnace the residue is fed by a Challenge feeder to another set of rolls, where lumps formed during the furnace treatment are broken up, and is then discharged to a second pug mill, where the final addition of acid is made. The amount of acid used here depends upon the consumption in the first step. Finally, the pug mill discharge is roasted in a McDougall furnace of the same type as used in the first operation. In this furnace, the reaction between the free acid and the ferrites is carried to completion, the excess free acid is expelled, and the ferric sulphate is decomposed. No free acid should be left in the furnace discharge, and the amount of soluble iron should be very low. Ferric sulphate, in decomposing, is changed into the brilliant red ferric oxide, and the color of the residue on the different hearths is a good indicator of the condition of the furnace. Too high a temperature must be avoided, as it would cause decomposition of the zinc sulphate, with subsequent formation of ferrites. Too low a temperature, on the other hand, leaves too much soluble iron. The capacity of this furnace is only about one-half of the furnace used in the first step, the operation of which is less complicated.

Following the roasting the residue is mixed with water in cylindrical vats, equipped with mechanical agitators, using a ratio of water to residue of about one to one, which gives a solution containing 140 to 150 grams of zinc per liter. No thickening is required, as the pulp is so high in solid content that it may be filtered directly in a Moore filter after passing through a Dorr classifier, where a small amount of coarse material is removed. After dewatering on an Oliver filter the Moore filter spigot is dried in a rotary dryer, together with the coarse material from the classifier, and is finally shipped to a lead smelter, where the lead, silver, and gold are recovered. The filtrate from the Moore filter is returned to the regular plant, where its zinc content is extracted, while the wash water and the filtrate from the Oliver filter are pumped to the agitators treating the roasted residue.

SIXTY YEARS AGO

1870-1930

☞THREE OR FOUR years ago there was some agitation for a tariff on copper, but that the subject is a hoary one is made evident from a perusal of the issues of *Engineering and Mining Journal* for 1869 (or the *American Journal of Mining*, as the magazine was then known). Before that time, a duty of 5 per cent was levied on imported ores. Evidence showed that—other commodities being highly protected—the cost of producing copper in the United States was 4c. a pound more than it would be otherwise; that the copper producers were suffering; that "over fifty millions of dollars have been invested" in the American copper industry, and with what result? In 1867 the various Lake Superior mining companies levied assessments of $2,335,000, whereas only two paid dividends—totaling $170,000. So the tariff was raised by Congress—over President Andrew Johnson's veto.

Copper was apparently used chiefly in shipbuilding in those days, for one of the chief arguments against the tariff was the prospective injury to the shipbuilding interests, which were pretty sick, as it was, for "Labor, in building a first-class wooden ship in America, costs about $75 per ton . . . in Great Britain, about $40 per ton."

Some thought that imported copper ores were required for a proper smelting mixture, but critics of that idea pointed out that, in the Ducktown district, two million pounds of copper a year was being produced, of a grade better than the Atlantic seaboard smelters were turning out. But maybe the charcoal used for fuel in Tennessee altered matters!

****

☞THE INDIAN HAZARD—One difficulty that menaced the miners of sixty years ago was the fact that the Indians did not look with particular pleasure on the inroads of the white man. A dispatch from Prescott, Ariz., says that, "Owing to the capture of the mails by Indians, we are unable to give an idea of what is being done in our sister counties. . . . What may we not hope for our noble territory when the Apache is quieted and the mantle of peace is spread over it?" And Governor Mitchell of New Mexico said: "There is no more certain and rapid method of exterminating the Indians that have so long cursed our country, than to fill its mountains and valleys with hardy miners, who, wherever they have been attracted by the mineral wealth and favorable conditions of the country, have permanently solved the Indian problem of removing the savages to a reservation in their happy hunting ground."

****

☞COPPER MARKET DRAGGING — The copper market was no more lively in those days than it was recently. "The sales of the week foot up 300,000 lb., part for cash, at 25¾ for all kinds." But look at the price! And in the same issue somebody says: "The price of copper all over the world has been for the last few years exceedingly low." But the world hasn't moved for lead and zinc, each of which were quoted at 6.30c.

****

☞SPORTING LIFE IN NEVADA—"Lumps of silver ore are now used as currency at White Pine, Nevada, the last silver discovery sensation. . . . A miner, with a sack of pure chloride ore under his arm, marches up to a faro table, takes out a chunk and places it on a card, calling its value as he puts it down. The banker picks it up, examines it, and if satisfied, replaces it on the card. In another moment he wins the lump, and throws it into a sack behind him." We wonder where the miner came in, or out.

****

☞FOR THE SUTRO TUNNEL — The leading editorial in the Jan. 2, 1869, issue is a plea for the Sutro tunnel to tap the Comstock lode, in Nevada. A hundred million dollars, it is said, had been extracted from the lode in the last nine years, but the cost was nearly as much, owing to the fact that 35 or 40 companies were doing independent work. The Sutro tunnel, it was argued, would prove the lode at depth, unite the competing companies, make beneficiation of low-grade ores possible, and remove much of the speculation that was going on.

****

☞ADVANTAGES OF RUBBER BOOTS —In those days, the "Answers to Correspondents" editor was expected not only to know everything about mining but to be an authority on other matters as well. Among the queries answered are: "What is the length of a meter?"; "Where should hot air registers be placed?"; "What is the force required to press a 500-lb. bale of cotton?"; "What are the medical properties of petroleum?"; "What causes writing ink to spoil?"; and "Is the continuous wearing of rubber boots injurious to the feet?" The answer to the last question is "Decidedly so. They retain the perspiration, and thus keep the feet moist, which is necessarily injurious. The only benefit, incidentally derived, is that they may soften corns, by keeping them constantly soaked in the water of perspiration."

****

☞IMPROVING ON THE CANDLE—After explaining why crude oil did not make a good illuminant, the same omniscient "A. to C." editor, winds up a discussion of the constituents of petroleum by saying that "the refining of petroleum . . . . is the best method after all, of securing a good light."

****

☞EARLY DAYS OF THE BLAKE CRUSHER—Though the Blake is now known merely as a type of crusher, sixty years ago, according to the advertisements, it was a proprietary article, known as Blake's Stone Breaker, with the name Eli W. Blake cast on the side, and manufactured by Blake Brothers, New Haven, Conn. It is either a great tribute to Mr. Blake, or a great reflection on modern engineers, that Blake crushers are still going into new installations.

****

☞ONE OF THE FEW THAT STILL EXIST—The mining news of sixty years ago contains few firm or company names that still exist, though the names of mining districts are, of course, familiar. Matthiessen & Hegeler's zinc smelter is one of the leading business enterprises of La Salle, Ill., and it evidently was attracting attention in 1870 as well, for we read: "Messrs. Matthiessen & Hegeler, of La Salle, Illinois, consume 100 tons of coal every 24 hours, at their zinc works. We understand that these gentlemen intend to sink a coal shaft for their own express use. . . . . The zinc works of these gentlemen are destined to be the most colossol [*sic*] of any manufacturing works in the West."

****

☞WHEN ALUMINUM WAS YOUNG —Aluminum, as is well known, is of comparative recent development. Sixty years ago its chief use was as aluminum bronze, a mixture of 10 parts of aluminum and 90 parts of copper, used for the manufacture of watch cases, watch chains, and imitation jewelry. "Four hundred pounds a month are now manufactured in France, and sold at twelve dollars a pound. It is largely produced in England." It was realized, however, that aluminum was a very common constituent of clays and rocks. "So abundant is this metal, that it is safe to predict that the day is not far distant when our houses may be built of it instead of bricks, and we shall use it for many purposes now unknown."

PLANT LIGHTING

A. H. Hubbell
Associate Editor

A COMMEMORATIVE postage stamp plus radio broadcasting and unusual magazine advertising brought the fiftieth anniversary of the birth of electric light to the attention of many who otherwise might never have thought of it. Few events, if any, stand out more vividly in 1929 than Light's Golden Jubilee, as one looks backward. The unique celebration was responsible. Stretching as it did over several months and reaching its climax in October, when Edison repeated his famous work, it left a lasting impression on the minds of many who previously had taken electric light for granted.

The wide publicity served two purposes: to make the public conscious of the achievement of the inventor, and to cause many to realize that they were failing to take advantage of the improved lighting methods devised in recent years and that a vast deal of specialized information on the technique of proper lighting had been amassed by the lamp manufacturers of the country.

Lighting seems a simple problem on the surface. You have a building, you put some lights in it, and the building is thereby lighted. If the effect is dim, the quantity of light is increased, or it is lessened perhaps if the interior seems too bright. Ridiculous as this sounds, it typifies the degree of attention given the subject of interior lighting in many instances, if one may presume to judge from the results.

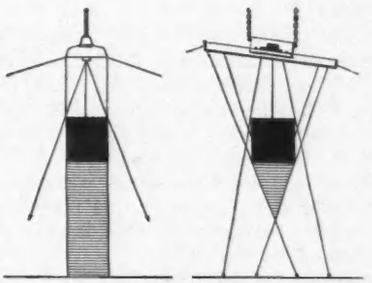
When Is Light Good Enough?

ONE OUTCOME of the campaign for better lighting that featured the year of the jubilee should be to make plant executives pause to consider whether or not their plants are properly illuminated. Reluctance to change what may seem to be good enough, but really is not, should disappear upon realization that accidents often result from improper lighting and that by improving light conditions better working results may be secured. Plant inspection may show that the requirements of good illumination are being violated. As quoted in a previous article[1], these are:

1. The light must be steady and of an intensity sufficient for requirements on all interior surfaces.
2. The light on walls near a working area must not vary in intensity from that on the working area, to avoid straining the workers' eyes through the sharp focusing that a strong contrast in the intensity of light on the two areas would necessitate.
3. The light must be suitable in color and specular character.
4. Glare must be avoided.

Advice Easily Obtained

DARK AND DIRTY walls that absorb much of the light falling upon them may play their part in poor illumination. Likewise, the improper location of the source of light, wrong selection as to strength and type of lamps, and other errors of the sort may give similar results. The rôle of paint in plant lighting was discussed in the article referred to. As for faults in the lighting system, it is not purposed to discuss them here. If illumination fails to meet the requirements set forth, advice is easily obtained. Lamp manufacturers have gone to great lengths and spent large sums to demonstrate effectively how to secure proper lighting under any and all conditions. At several places in the United States, notably in New York, they have established permanent exhibits ingeniously arranged to show convincingly the right and wrong ways of lighting industrial plants inside and out, business establishments, homes, and municipalities. Inspection of these unique exhibits will be worth the while of anyone.



Left, the shadow resulting from use of ordinary incandescent or arc lamp, depicting the difficulty experienced when source is concentrated. Right, showing how extended source of mercury vapor light makes objectionable shadows impossible.

Following the appearance in *E.&M.J.* of July 20, 1929, of an article entitled "More Light for the Mine Workings," a correspondent informed the writer that Cooper-Hewitt lighting—that is, the mercury vapor lamp—had been used in and around mine workings. One of the large gold-mining companies in South Africa, it seems, had found this lamp so satisfactory in its machine shop and in its crushing and concentrating and other departments on the surface that it had installed it in certain places underground and had found it to be most pleasing.

Anyone who has studied elementary physics will recall the mercury vapor lamp. Practical use has long been made of it in lighting manufacturing plants and for illuminating displays in shop windows. To the mining industry it is little known. A brief description of it and its application follows:

Two types of industrial lighting are in use today. One is that obtained with the incandescant filament lamp; the other the mercury vapor system. These two systems differ considerably from each other in the methods employed to generate the light and in the characteristcs of the illumination they produce.

Green Light Restful

GLOWING mercury vapor contained in a long glass tube that has been exhausted of its air is the source of Cooper-Hewitt light. Its color, bluish-green, is the light's most striking characteristic. It is most agreeable and restful to the eye. Of the entire spectrum, only yellow, green, and blue enter into its composition. The light has a simple line spectrum containing only two groups widely separated and characteristic of the element mercury, this in contrast with light from the sun and incandescent solids. One of these groups — the yellow-green — constitutes 90 per cent of the effective light. The other—blue-violet—contributes the remaining 10 per cent. The rays from the mercury vapor lamp are therefore practically pure light, being free from the heat accompanying the orange and red rays. Red is totally missing, which accounts for much of the ease of vision under the light. Red, moreover, has low visual value, increases the glare effect, and tends to irritate the eye.

"Green and greenish-yellow light are the most harmless, the least irritating to the eye, as they represent the least power," said Steinmetz. "We feel this

[1] "The Role of Paint in Plant Lighting," *E.&M.J.*, May 19, 1928.

effect and express it by speaking of the green light as 'cold light' and of the red and orange light as 'hot' or 'warm.' The harmful effect of working very much under artificial illumination is largely due to this energy effect, incident to the large amount of orange, red, and especially ultra-red in the radiation of the incandescent bodies used for illumination, and this does not exist with 'cold light,' as the light of the mercury vapor lamp."

Speed in Seeing

VISUAL ACUITY or sharpness of vision is greater under the mercury vapor light. This is well substantiated. A certain length of time is required after the image of an object falls on the retina for the mind to see the object. Light of one color has been found to produce the full sensation more quickly than white light, and yellow and green have been found to produce it more quickly than the other colors. Investigations have shown, moreover, that Cooper-Hewitt light adds to the ability of the eye to see in shadows by increasing light-and-shade contrast by 50 per cent. The greater this contrast the more boldly objects stand out. By this increase the mercury vapor light has the same visual effect upon objects in shadow as a 50 per cent increase in the general surface brightness would have in the case of ordinary light. These statements are based on data supplied by the Cooper-Hewitt Electric Company.

As commonly used, the mercury vapor lamp has a tube 50 in. in length, so that the light shines around any article smaller than this. This is illustrated in the accompanying sketch. The few shadows such as are bound to occur in any lighting system are soft and luminous. Owing to the large luminous area of the source of light, glare points and direct glare are absent. Dense shadows are lacking, as the diffusion is almost perfect. Moreover, because of the softness of the light and the size of the source no dazzling reflection occurs when the light is used over a polished or wet surface.

Light in Ore Sorting

FOR THE reasons given, Cooper-Hewitt lighting has been found advantageous wherever operations can be speeded up by increased sharpness of vision. Ore sorting furnishes such an instance; machine shop work another. A short account of the results obtained at his plant was given by E. C. J. Meyer, manager of the New Modderfontein Gold Mining Company, on the Rand, in the November, 1927, issue of the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa.

That this light was better than the ordinary incandescent lamp for sorting was undoubted, Mr. Meyer said, and possibly it might prove better than daylight, because it was always the same and did not depend on the weather or the time of day. Carbon specks and mineral matter seemed to show up under bold relief under it and badly washed rock was easily detected.

To test the efficacy of the mercury vapor lamp, a portion of one of the sorting tables at the New Modderfontein mill was screened to exclude all outside light. One Cooper-Hewitt lamp was erected inside the screened portion and various types of rock were examined under its light. It was found that the light showed up the carbon seams very clearly and that generally it gave a better and more effective light than either electric light or daylight. Sorting was then done on this part of the table by the ordinary sorting "boys" in couples so as to accustom them to the light and to teach them the appearance of the carbon seams. This was continued for about two weeks, and then another table was equipped with four of these lamps, this number being considered adequate for the whole table. The experimental sorting showed that it was possible under this light to distinguish very clearly between the different kinds of rock on the table and more especially to pick out the rocks containing carbon specks.

After one table had been equipped and the "boys" were sorting in the customary manner, it became evident, said Mr. Meyer, that the visual acuity of the sorting "boys" had been increased and that they were sorting more effectively.

In Résumé

TO RECAPITULATE the benefits of mercury vapor light: it is free from glare, does not create sharp, black shadows, and is easiest of all lighting on the eyes. Moreover, it shows up small objects and fine details better than any other kind of light, daylight not excepted, and enables one to see better in dark places. As a result, the hand responds to sight more quickly than under daylight or electric light.

Status of Mineral-bearing Public Lands

ACCORDING to the annual report of the Director of the U. S. Geological Survey, the gross areas of public lands already classified as valuable for mineral and those remaining withdrawn at the end of June 30, 1929, were as follows:

Coal land withdrawn, 29,883,366 acres; classified as coal land, 31,944,983 acres; oil lands withdrawn, 5,183,096 acres; classified as oil land, 71,884 acres; oil-shale areas withdrawn, 156,147 acres; classified as oil-shale land, 4,116,097 acres; phosphate areas withdrawn, 2,005,045 acres; classified as phosphate land, 300,482 acres; potash land withdrawn, 9,411,939 acres.

During the fiscal year, but antedating March 12, 1929, 4,131 prospecting permits were received, of which 4,093 were acted upon and 38 were pending; 114 leases were also received, of which 102 were acted upon and twelve were pending. At the close of the fiscal year 120,266,561 acres were outstanding as stock-raising homestead designations. Such designations during the fiscal year totaled 1,143,677 acres and cancellations, 1,720 acres.

In the mineral-leasing division there were under supervision of the U. S. Geological Survey, June 30, 1929, the following:

Coal leases, 285, involving 98,030 acres; coal permits, 221, involving 253,955 acres; coal licenses, 23, involving 866.3 acres; oil and gas leases, 597, and 15,442 permits; sodium leases, one, involving 1,440 acres, and 25 permits involving 43,090.7 acres; potash leases totaled four, involving 7,783.8 acres, and permits 102, involving 226,842.6 acres. Productive leases totaled 795. Petroleum production from public lands for the fiscal year was 22,458,842 bbl.; coal, 3,161,831 tons; sodium salts, 23,581 tons, and phosphate 21,792 tons.

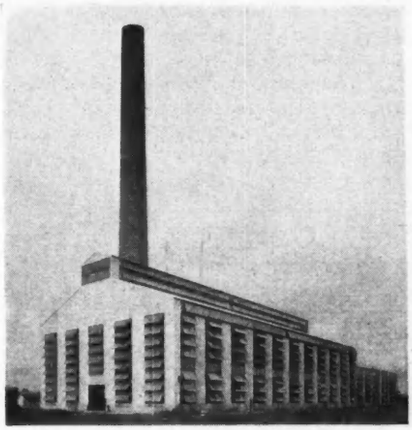
Accrued income from all mineral leases, licenses, and prospecting permits totaled $4,100,069, including $3,685,883 from petroleum, natural gas, and gasoline; $397,964 from coal; $1,440 from sodium salts; $2,308 from phosphate; and $11,989 from potash.

Sulphur Mining

Description of the Frasch process and an account of the operation of a new plant at Newgulf, Texas

G. G. Hollins

Mechanical Engineer,
J. G. White Engineering Corporation, N. Y.



General view of the new power plant of Texas Gulf Sulphur

THE sulphur deposits of the Texas Gulf Sulphur Company, at Newgulf, Wharton County, Tex., occur at what are called salt domes. The sulphur is found in veins in the lime rock overlying the salt dome. Over the sulphur-bearing rock is a more or less impervious rock, and then occur layers of clay, sand, and quicksand which extend to the surface of the ground.

Sulphur mining on the Gulf Coast of Texas is done by the Frasch process, in which water at a temperature above the melting point of sulphur is pumped into the ground. The resulting molten sulphur is then raised by an air lift.

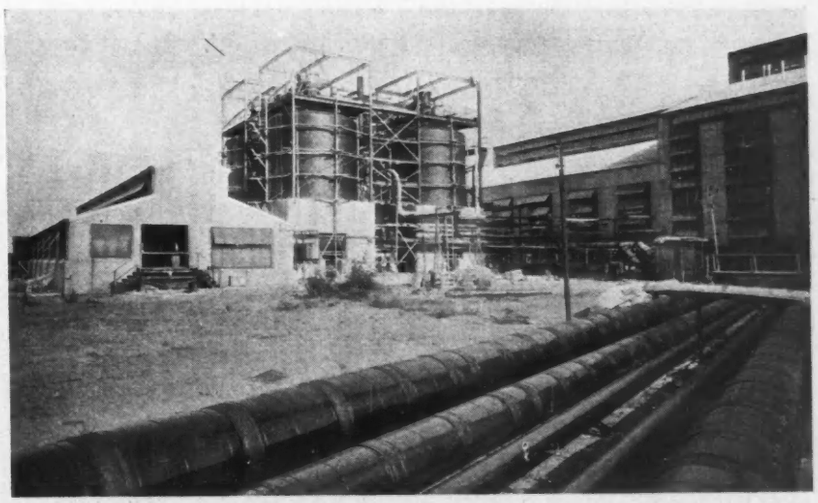
A sulphur well in this field is about 700 ft. deep, the actual depth depending on the depth of the sulphur deposit. In each well are three pipes, one inside the other. The outside pipe is 6 in. in diameter; the middle pipe, 3 in.; the center one, 1 in. The outer pipe conveys hot water into the ground; in the middle pipe flows the molten sulphur, which is raised by compressed air passing down the center pipe.

In practice, the method for raising the sulphur by compressed air is similar to the well-known air lift in water wells. The accumulation of water underground furnishes the necessary pressure for the successful working of the lift. In a good sulphur deposit the character of the ground prevents the water added from escaping. In time a pressure develops, which, unless relieved, would prevent more hot water being forced down to the sulphur. To maintain the circulation of the hot water, the cooled water in the ground is permitted to escape through what are known as bleed wells. The pressure to force the water out of the bleed wells is maintained by the incoming hot water and the weight of the ground above, which tends to subside as the sulphur is removed.

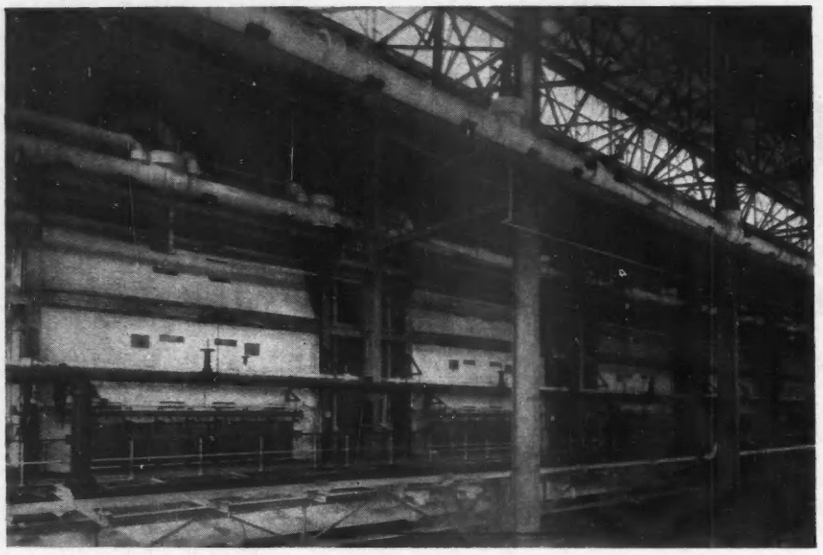
After a deposit has been worked for some time it becomes so hot that the escaping bleed water contains a considerable amount of heat, which may be transferred to the water used in the wells. So far it has not been practicable to re-use the bleed water by heating it to the required temperature, because it contains substances that would cause difficulty with pumps and piping.

Sulphur, when melted, acts unlike most other substances. As the temperature is raised above the melting point, it commences to thicken. At a few degrees higher it becomes so viscous that it cannot be pumped or transported in pipes, and the temperature must be raised considerably before it is again fluid. For economic reasons it is necessary to use the lower range of temperature at which it is fluid, and on account of the narrowness of this range the temperature must be accurately controlled. If the temperature goes beyond the desired range, the wells, pipes, or pumps may choke as a result of the sulphur solidifying or becoming too viscous.

If the sulphur at the bottom of a well, which forms a pool into which the well pipes extend, solidifies from an interruption of the hot-water supply or the lowering of the water temperature, the lower ends of the pipes become plugged, which usually means the loss of the well. Owing to the stoppage of circulation there is no way to apply heat to melt the obstructing sulphur. On this account



North side of the plant, showing water softeners and first-stage heaters; building for water treatment and storage of chemicals; and hot water, cold water, steam, and compressed air piping from plant to sulphur wells



Front view of the 1,500-hp. boilers

it is important that there be no failure of the hot-water supply or lowering of the temperature if the wells are to be kept in service. In the design of the power plant, first consideration was given to maintaining the hot-water supply. Although the amount of fuel used makes the efficiency of the plant important, no equipment has been installed to increase efficiency at the expense of complication or hazard to reliability.

The first unit of the power plant is designed to heat 3¾ million gallons of water per day to a temperature of 320 deg. F., to supply compressed air for the air lifts at pressures from 400 to 650 lb. per square inch, to furnish electric power for pumps and other purposes, and some steam for heating sulphur pipe lines, measuring tanks, and pumps. Provision is made in the design for increasing the hot-water supply to double the initial amount, and space in the building has been provided for additional boilers and other equipment, now on order.

In mining the sulphur, the water is heated in two stages—(1) in the hot process softeners, with jet heaters designed to operate up to 20-lb. pressure; and (2) after passage through sedimentation tanks and filters, by mine heaters, which are also the jet type and operate with steam, at 75- to 100-lb. pressure, direct from the boilers. From the mine heaters the water is pumped into the pipe lines to the wells, some of which are 2½ miles distant.

The mine heaters are mounted on horizontal cylindrical tanks fitted with gage glasses and floats, to control the admission of water. The temperature of the heated water is controlled by the pressure of steam in the heaters, as the water is heated to within a few degrees of steam temperature. Under the mine heaters are the mine water pumps, which can increase the water pressure to 250 lb., to overcome the resistance of the long pipe lines to the wells. As the temperature of the water is about that of saturated steam at 80-lb. pressure, it must be kept above this pressure so as to prevent its flashing into steam.

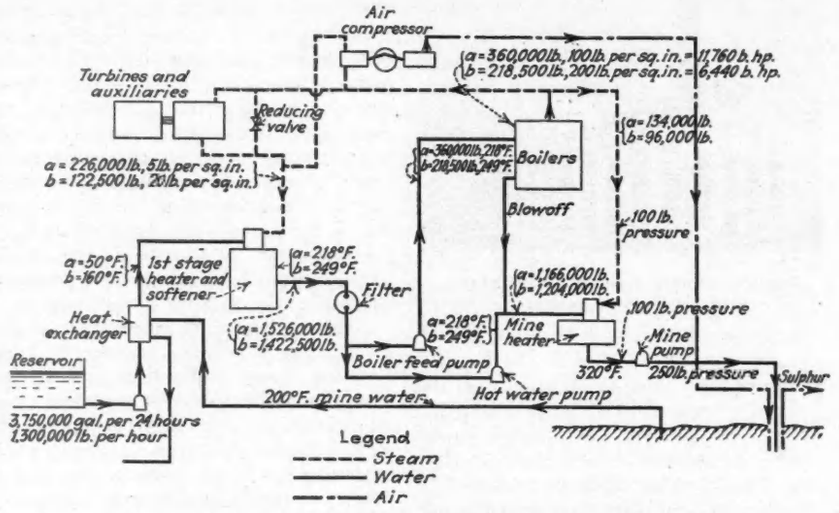
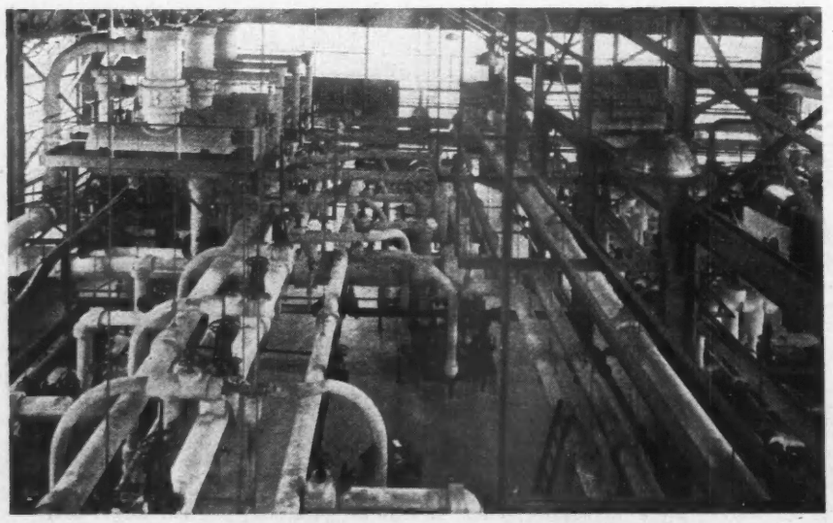


Fig. 1—Diagrammatic sketch showing flow of steam, water, and compressed air

The boilers (Stirling water tube), for 225-lb. pressure, are set singly and fired by natural gas or oil. There are no superheaters. The greater part of the steam is used for heating water, and as all the exhaust of the turbines is used in the heaters, there is no advantage in further reducing their water rate.

All the boilers have air-cooled furnaces. At 200 per cent rating, the air, heated to a little over 200 deg. F., is drawn through the settings by the forced-draft fans (one per boiler), which discharge into a common duct from which branches go to the burner wind boxes. The air-cooled parts of the settings are provided with auxiliary dampers to permit natural air circulation if the fan is out of service.

The present fuel is natural gas, with oil as a reserve if the supply of gas should fail, but the installation is designed to be easily adapted to the use of powdered lignite. The settings have been made with sufficient furnace volume for



The pump room; water heaters are seen at the upper left

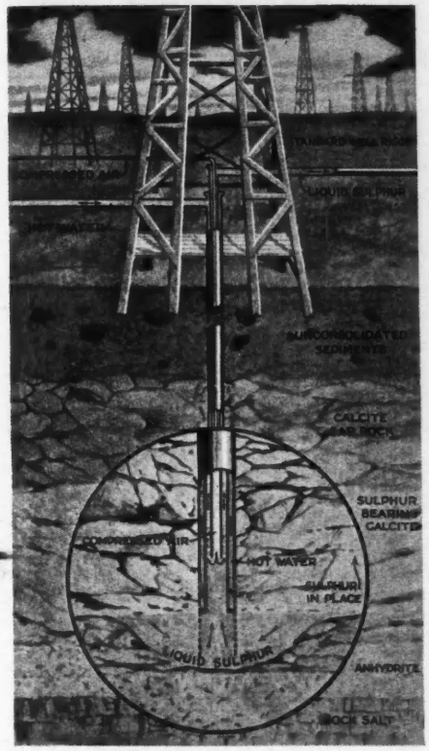


Fig. 2—Hot water is pumped down the outer of three concentric pipes to the sulphur formation, which it enters through openings in the pipe. The sulphur thus melted, being heavier than water, collects at the bottom of the well. Compressed air introduced through the center pipe forces the liquid sulphur to the surface, where it is collected in sumps. Centrifugal pumps lift the sulphur into vats, where it solidifies and is later broken down for shipping

this fuel and provision made for the removal of ash. Boiler room steelwork has been designed to permit the installation of overhead bunkers.

A pumping station at the San Bernard River about a mile away from the power house supplies the water used. This stream varies in flow, and the difference in water elevation between low and high water is about 50 ft. The station contains four vertical motor driven pumps, each having a capacity of 10,000 g.p.m. The motors have been placed above extreme high water, and the pumps are designed to be submerged when the elevation of the water is abnormal. High water does not last long, and the pump compartment is provided with dewatering equipment, so that it may be rapidly cleared when the flood recedes. The capacity of the pumps is above the available river flow at low stage; but plans provide for doing most of the pumping when the river is high, as the water is then softer and can be treated at less cost. A reservoir of about one thousand million gallons' capacity receives the water from the river, and insures a supply even under unusual shortage.

Particular attention was paid to the lighting of the building, made up of Holophane glass units, high bay units with aluminum hoods in the high bays, and brackets with inclosed units.

A Forerunner of the Modern Ball Mill

ONE of the pioneer types of ball mills was described in the *Mining and Scientific Press*, July 6, 1878. It was invented by William Brückner in 1876. The description of this pulverizer is given as follows:

"It is constructed somewhat on the principle of the ordinary bolt-polisher, with which every machinist is familiar. It consists in the main of a cylinder 4 ft. long and 4 ft. in diameter, in which a number of iron balls are placed, and which when the machine is charged with ore is rotated to produce the necessary grinding. The above cylinder is constructed of flat steel rails of about 3½ in. in width, placed hoop-like at distances of 3.32 in. apart, and securely fastened together by iron braces. The ends of the cylinder are made of strong sheet iron. The ore is charged by any continuous feeder through one of the trunnions on which the barrel turns. Around the cylinder and fastened to it is placed a cone of cast iron, so that the pulverized ore falling through the apertures between the rails is caught by the cone and carried by gravity to the part having the greatest diameter. Here is placed a hollow, annular ring, which forms a natural depository for the ore. This ring contains two cylindrical sieves. The one is made of strong punched iron or steel, and is made with No. 18 holes. This simply serves to protect the other, a wire screen, which is placed directly beneath it.

"The next object is to remove the pulverized ore, which after having passed the No. 30 screen lies at the lowest part of the outermost compartment of the annular ring spoken of above. This is effected by a curved tube or channel of cast iron, which runs from the bottom of the outer compartment along the end of the cylinder. to the hollow trunnion opposite that at which the ore entered the cylinder. With such an arrangement it is evident that the revolution of the cylinder will naturally discharge the pulverized ore through the hollow trunnion. By a similar arrangement all the ore which has passed the No. 18 sieve, but not the No. 30, as well as that which was too coarse for the No. 18, is taken by a similar tube and discharged back into the cylinder itself for repulverization.

"A LITTLE reflection will make the working plain, and it is evident that the whole operation is automatic and that with a proper ore feeder no attention whatever is required to the apparatus. In a cylinder of the dimensions given it is usual to work with about 1,500 lb. of iron balls. The sizes used varied from 2½ to 5 in.

"THE size of the balls varies with the nature of the ore. The smaller sizes seem best adapted to fine grinding. For the harder varieties of quartz and the tougher rocks the larger ones are required. For soft or brittle ore the small ones are best adapted. The balls were first made of chilled iron, but they were found to be not sufficiently durable. In many cases they did not last more than two weeks before they crumbled to powder. They are now made of cast steel which has afterwards been forged, but experience proves that wrought iron is more durable than cast steel.

"The cylinder is run at a speed of from 15 to 22 r.p.m. A 5- to 7-hp. engine is needed. At Baranca, one of these mills pulverizes dry, to pass through a No. 35 screen, 25 tons of a quartzose ore in 24 hours. For dry crushing in particular, this machine seems specially adapted. The cylinder is usually run in connection with a Blake stone breaker, and can be fed with anything from 2 to 4 in. in diameter."

Carl A. Stetefeldt, in describing the Marsac mill, Park City, Utah, in 1891, has this to say about the Brückner pulverizer:

"FOR pulverizing the matte, I imported a small Brückner ball mill, with drum 800 mm. in diameter and 500 mm. wide, made by Sachsenberg Brothers, Rosslan, Germany. It is exceedingly well constructed and suited for pulverizing silver-copper matte. Large machines are used for this purpose at the Ziervogel extraction works, Mansfeld, Germany. The pulverizer makes 28 r.p.m., requires about 1½ hp. to run it, and pulverized about 150 lb. of matte per hour through a No. 4 brass wire-screen. The wear and tear is hardly perceptible. Forged wrought-iron balls are used. These were on hand at the Ontario mill from a discarded Brückner pulverizer, erected many years ago. That machine was put up for pulverizing salt, which it did very well, but it had been so poorly constructed in one of the San Francisco foundries that it broke down at least once every 24 hours. Brückner's pulverizer would have been as great a success in the United States as it is in Germany if well-constructed machines of the Sachsenberg type had been put on the market."

Personal Notes

A. B. PARSONS

A. B. Parsons has been elected assistant secretary of the American Institute of Mining and Metallurgical Engineers. Mr. Parsons takes the position made vacant recently by the resignation of Dr. **Thomas T. Read**, who became professor of mining at Columbia University. Mr. Parsons was formerly associate editor of *Engineering and Mining Journal*, and, more recently, president of the Mineral Research Corporation.

Herbert Stanton has returned to San Francisco from a trip to Mazatlan, Sinaloa, Mexico.

Fred C. Carstarphen was recently in New York to receive the Wellington medal awarded by the American Society of Civil Engineers.

Dr. **T. C. Witherspoon**, of Butte, delivered a lecture, on sanitation and health in mining camps, at the Montana School of Mines, on Jan. 7.

J. S. Henderson was elected president of Lexington Consolidated Mines, Idaho Springs, Colo., at a recent meeting of the board of directors.

H. C. Bellinger sailed from New York recently, on a trip of inspection of the properties of the Chile Exploration Company, at Chuquicamata.

Arthur Swanson, superintendent of the Pend Oreille Mines & Metals Company's properties at Metaline Falls, Wash., resigned on Jan. 1.

James S. Wroth, mining engineer in charge of potash explorations for the U. S. Bureau of Mines, has resigned to enter private employment.

O. M. Schaus, of Cleveland, Ohio, and **J. M. Price**, of Ramsay, Mich., both of the staff of Oglebay, Norton & Company, sailed recently for Russia.

William F. Hayden, consulting engineer, has returned to his office at Salt Lake City, after a recent trip to Washington, D. C., and New York.

George A. Packard passed through New York recently on his way to Florida, where he will remain for about a month before returning to Boston.

Emil Koyen, of 610 Barron Ave., Woodbridge, N. J., is anxious to hear of or from his son, **Walter Koyen**, mining engineer, who for some time was at Bisbee, Ariz.

Clyde M. Pearce has resigned his position as manager of the Emeralite Surfacing Products Company, at Ely, Minn., and plans an extended trip through the South and West.

Donald Morgan, mining engineer at the New Idria quicksilver mine, at Idria, Calif., was injured recently in an automobile accident, while en route to the mine from Hollister.

J. L. Agnew, president of the International Nickel Company of Canada, Ltd., has been elected a member of the council of the Ontario Metal Industries Research Association.

Alfred B. Sabin, engineer of El Tigre Mining, of Sonora, Mexico, returned to the mine recently, after two months spent in examining various Colorado mining properties for his company.

S. POWER WARREN

S. Power Warren, professor of ore dressing at the Colorado School of Mines, took advantage of the recent holidays to make a trip to the mine and mill of the Stirling Mine, Ltd., at Stirling, Nova Scotia, where a concentrating mill designed by him is under construction.

James Caldwell has been appointed general manager of Mazapil Copper, at Concepcion del Oro, Zacatecas, Mexico. Mr. Caldwell fills the vacancy created by the recent resignation of **L. D. Fry.**

Prof. **Arthur T. Tieje**, chairman of the department of geology at the University of Southern California, will have charge of classes in geology at Columbia University during the summer session of 1930.

Nelson Dickerman, mining engineer, with Associated Engineers, sailed from San Francisco on Jan. 15, for Japan. He will return to London after a month of inspection of his company's operations in Japan.

Corbin T. Eddy, physical metallurgist, has been awarded first place for outstanding work in metallurgical research for the year 1929 at the Michigan College of Mining and Technology, at Houghton.

Col. **H. H. Stout**, consulting metallurgist of Phelps Dodge Corporation, has established separate offices for independent consulting work. He will continue to devote some of his time to consulting work for Phelps Dodge.

Frank L. Hess, recently returned from a trip around the world, presented a "Geologic Travelogue of the Far East," illustrated by moving pictures taken by the author, at the Jan. 23 meeting of the Washington, D. C., section of the A.I.M.E.

J. Koster, of the Western Electric Company, has been appointed to a fellowship in the department of mining and metallurgical research of the U. S. Bureau of Mines station at the University of Utah, Salt Lake City. He will be in charge of the recently acquired X-ray laboratory.

J. J. Jakosky, consulting engineer for the Radiore Company, has resigned to accept the position of general manager of the International Geophysics Company, Ltd., with headquarters in Los Angeles. **V. P. Pentegoff**, chief geologist of the Radiore Company, has also resigned to accept a similar position with the International company.

John N. Dynan, formerly in charge of development at Wickenburg, Ariz., for Tonopah Belmont, has been appointed superintendent of the Gold Hill Development Company, at Round Mountain, Nev. He is a graduate of the Lehigh School of Mines. Before going to Arizona, Mr. Dynan was superintendent of Tonopah Extension, at Tonopah, Nev.

OBITUARY

Thomas G. Condon, a director of various mining and metal companies, died at his home in New York City on Jan. 1. He was 66 years of age, and is survived by his widow, a son, and two daughters.

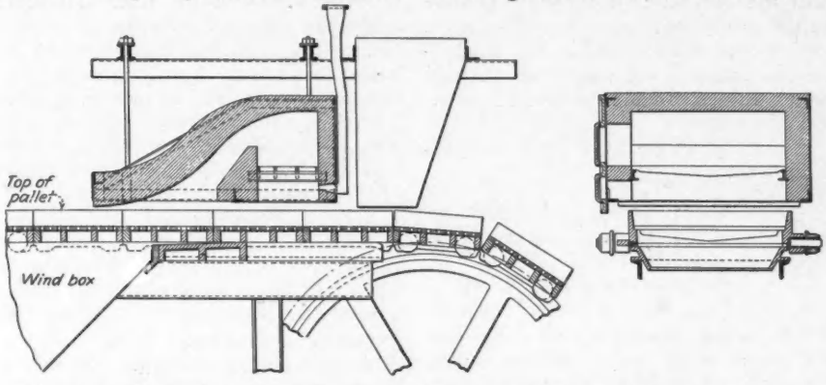
Marmaduke B. Holt, mining engineer and owner of several Colorado mining properties, died suddenly on Dec. 26, in Denver. Mr. Holt, who was 60 years of age, was a graduate of Columbia University, class of 1889.

Clifford Crowell, consulting engineer, died recently at his home in San Antonio, Tex. Mr. Crowell had spent the last 40 years operating small mining properties in Mexico, and invented a grinding mill and screen. He was 61 years of age.

N. W. Roberts, active for 50 years as an operator in the Tintic district of Utah, died recently at his home in Provo, after a short illness. Mr. Roberts was superintendent of the Iron King mine for twenty years, and located many of the claims now being worked in the East Tintic district.

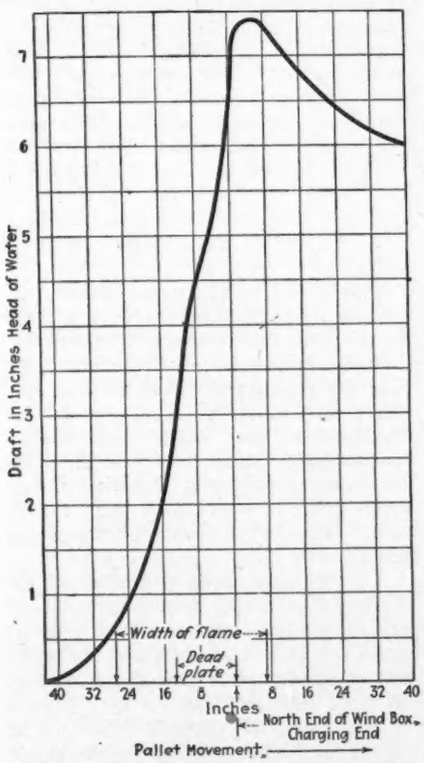
Sintering Machine Igniter Perfected at Bunker Hill Smelter

THE Bunker Hill Smelter has developed an improved type of ignition muffle for the Dwight-Lloyd sintering machines, on which improvement has long been needed, especially in plants where a charge high in lead is roasted, writes A. F. Beasley, superintendent. This new type of igniter insures better ignition and a more uniform and better product than has been possible previously on any type of muffle known to the art. It will be known as the Beasley combustion igniter. Solid or liquid fuels may be used with this igniter, which is illustrated herewith.

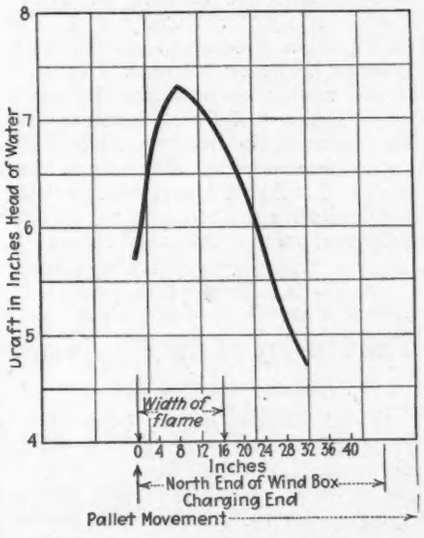


Sectional drawings showing design of Beasley combustion igniter for sintering machine fired with solid fuel

As will be seen, the dead plate at the charging end of the machine is tilted slightly downward and forward toward the wind box, to allow a small amount of leakage therefrom. Naturally, the draft back of the wind box through the charge diminishes as the distance increases from the wind box. The length of the new igniter is much greater than anything of like character heretofore used. The flame and products of combustion are made to travel both downwardly and forwardly, parallel with the direction of the pallet travel, rather than being laterally confined across the ore bed within narrow limits, as in all other previous methods of ignition.



Distribution of draft as pallet passes under the Beasley igniter



Distribution of draft as pallet passes under the Salida igniter

At the Bunker Hill Smelter this igniter has been found to be especially adapted for ores containing a low percentage of sulphur and a high percentage of lead. In continuous use, it gives better results than with any other type of igniter.

The initial ignition takes place where the suction through the ore charge is only slightly above zero pressure, and where the flame and heat of the products of combustion are at their greatest distance upwardly from the ore bed, and, consequently, at the coolest point in the muffle. As the pallet moves forward in its path, suction gradually increases until the pallet passes over the wind box. During the pallet's forward movement, heat gradually increases, aided by the downward and forward sloping arch roof or flame retainer of the igniter. Note that the arch almost flattens out, so that it is just above the ore bed when it reaches the wind box.

With the Beasley combustion igniter the ore is ignited with the least amount of heat and suction, gradually increasing both until the pallet reaches the wind box, where the greatest amount of suction occurs and the arch is at its lowest point, thus giving the most intense heat. The sulphur is not merely kindled, as in other igniters, but ignition is advanced both in length and breadth of the orebody, and also in depth, so that ignition in this device amounts to a well-advanced combustion before the ore reaches or is subject to the full action of the wind box. Thus is prevented the fusing of the top of the ore charge, which so often forms a seal, preventing the free passage of air and good roasting, a condition which occurs frequently when the charge is ignited initially over the wind box, with a maximum amount of suction and intense heat over a narrow width.

The accompanying graphs show the suction in inches of water in the pallet travel through the Beasley combustion igniter and also through the Salida type of burner heretofore used at the Bunker Hill plant. These graphs readily show the advantages to be derived in igniting a charge both low in sulphur and high in lead with the Beasley igniter.

The foregoing article, now in correct form, appeared in the Jan. 9, 1930, issue of *Engineering and Mining Journal* with an unfortunate transposition of the captions of the two graphs—the result of an unexplained change in the pressroom after the page had been checked and approved. Our apologies are tendered to Mr. Beasley for disseminating so misleading an impression of the outcome of this interesting development at the Bunker Hill Smelter—EDITOR.

COMMENT AND CRITICISM

A Chapter in the Metallurgical History of Liberty Bell

To the Editor of "E.&M.J.":

The discussion in your columns on impoverishment of ore early in its treatment recalls to my mind that the final development of the milling practice at Liberty Bell mill, at Telluride, has not before been published. It is pertinent to the discussion and certainly should be recorded, even after a decade.

Cyanidation in that plant began as an adjunct and became the sole process, the stages of development being:

1900-1905: Amalgamation, and table and canvas concentration, all in water; and leaching of the sand tailing with cyanide.

1906-1913: Amalgamation, table concentration after tube-mill regrinding, and agitation, all in cyanide solution.

1913: Amalgamation, concentration, and agitation, as above plus heat; *followed by special cyanidation of the table concentrate,* it being ground to 300 mesh and agitated, all in strong and warm solution.

1914-1917: As in the prior period, *but with amalgamation omitted.* Much of this time a low-grade residue from concentrate treatment was shipped to smelter.

1918-1919: The process essentially as before, but four specially decked and riffled tables, to treat 100 tons each, were interpolated after the battery. Mercury was introduced as a reagent.

The results of this early diversion of rich concentrate were striking; the amount of gold and silver into the concentrate-treatment plant was about doubled, and the general mill circuit was correspondingly impoverished. Solution from this plant, assaying $25 to $40 per ton, carried about 75 per cent of the total metal of the ore; and, having been totally robbed of oxygen in the grinding, it precipitated perfectly, with large economy of zinc. Minute additions of mercury, as nitrate, in both branches of the plant, were essential; and therein lies a tale. When amalgamation was first abandoned, the residue from the concentrate plant was satisfactory. Gradually the residue increased in value and its shipment became established practice. Four years later mercury as a reagent showed remarkably low tailing, both in the concentrate-treatment plant and in the larger circuit. The reason for the gradual rise in concentrate residue four years before became evident at a sadly late date; the change being coincident with entry to a new area of somewhat different ore characteristics, it had been rashly assumed that the ore was not equally amenable to the established treatment, whereas in reality the discontinuance of amalgamation removed the source of mercury which subsequent events showed essential as a reagent.

Results in the final two years of operation were:

	Gold		Silver	
	1918	1919	1918	1919
Head	0.529	0.370	2.565	1.501
Tailing	0.012	0.015	0.376	0.317
Per cent extraction	98	96	85	78

■

The entire production of these last two years went out as bullion. The operation was efficient and economical. These last developments in the mill practice were the final contributions of Mr. Arthur J. Weinig to a metallurgical battle that began in 1900 with extractions of 83 and 36 per cent, respectively in gold and silver, of which 9 and 15 per cent were in concentrate.

The ore contained quartz associated with considerable amounts of calcite, altered feldspathic country rock, and kaolin. Sulphides and oxides were present in lesser amounts. The ore slimed readily, necessitating the use of large settler and filter capacities. In the beginning the iron pyrite was 2 per cent, more or less, but latterly this increased and small percentages of zinc and lead were present.

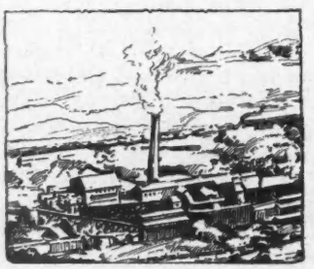
Silverton, Colo. CHARLES A. CHASE.

■

The Passing of the Prospector

To the Editor of "E.&M.J.":

Would it not be a good idea, at this time, to formulate some plan to replace and foster a substitute for the old prospector, his prospect, and the little fellow trying to put the prospect on a paying or partly paying basis, while still developing and trying to prove up his ore (or rather junore), and turn his prospect into a mine?



Mining is now, and has ever been, the vision of unlimited wealth, and today is no exception to the rule. To scrap a hundred thousand dollar plant to build one costing two hundred thousand or more, to save a slightly greater percentage of metal, and to reduce, by even a small margin, the per-ton cost of handling, is a common occurrence. Each step in advancement, however, is made at the expense of the life of the mine. A systematic development of the mines of tomorrow must be made, for in an unbelievably short time the mines of today will be of yesterday, and, unless some showing is made, we will be "all dressed up and no place to go."

In small mining operations, especially for the precious metals, the spread between the present cost of production and the price of the product is so slight that there can be no very great margin of profit. Another drawback is the lack of facilities for obtaining information as to the cheapest and best methods of mining, milling, and extraction. In the old days, many a gold mine was brought to the production stage by two or three partners working at it, grinding out in an arastre or pounding out in a hand mortar about enough to pay, or partly pay, their expenses. Sowbelly, beans, sourdough bread, and coffee constituted the principal diet. Their rifles furnished fresh meat, and wild berries and honey helped out. Fir bark and charcoal were used for sharpening, and rock hammers, gads, and moils were useful and usual tools.

This is all of the past. Today, the cost of living has advanced to a point so that the labor involved in sinking, drifting, mucking, and timbering is altogether a different problem than formerly, and must be taken over by the venturesome few with more means. Continuous work in hard rock now calls for compressors and machines, and, where gold ore especially is being mined, some form of grinding machinery is needed.

A concise description of some of the small plants in operation, improvements and equipment suggested by engineers, and a survey and tabulation of the mines and prospects in the various mineralized districts, similar to the Annual Reports by Mr. Stewart Campbell, Inspector of Mines for Idaho, and such as the Baker Chamber of Commerce and the Mining Men's Association have achieved for eastern Oregon, will go far in fostering interest in the possible mineral resources of the country.

GEORGE H. BODFISH.

Malheur, Ore.

INDUSTRIAL PROGRESS

Improved Explosives and Blasting Accessories

Indicators of Progress in Industry

IN A REVIEW covering activities in the explosives industry during 1929 the explosives department of E. I. du Pont de Nemours & Company points out a number of important advances, including extension of use of certain explosives, development of new explosives, progress of new methods of manufacture, and perfection of new blasting accessories.

The low-density permissibles of the ammonium nitrate type are still gaining in popularity, the review states. These explosives, on account of their relatively low density, run a very large number of cartridges to the 50-lb. case. They have less shattering effect than the higher-density type of explosives

Still further expansion has taken place in use of so-called low-density ammonia dynamites. These were developed and put on the market in 1927 for the purpose of providing explosives more economical for use in mines where high-powered, shattering explosives are not necessary. They are available with stick strengths ranging from 20 to 55 per cent, but vary in density or sticks per 50 lb., depending upon the stick strength desired. For example, the 20 per cent powder runs 170 sticks per 50 lb., whereas the 55 per cent powder runs 115 sticks per 50 lb. In numerous mines in the country the replacement of the old standard dynamites by these new ones has brought about an unusual reduction in the explosive cost per ton of ore.

During 1929 these low-density ammonia dynamites were improved in making them more cohesive, thus increasing their value for use in mines where trouble is frequently had with crumbling of granular types of dynamites from holes during loading.

Semi-gelatinous ammonia dynamites have recently been developed, these being more resistant to water than the old standard ammonia dynamites. Just how great a field these explosives will have remains to be seen.

Dynamite and Geophysical Prospecting

CONSUMPTION of dynamite in oil exploration work has become fairly large, particularly in Louisiana and Texas, where the seismographic method is used extensively. Numerous types of explosives have been tried in this work to determine which are best for the purpose and even special explosives have been made to determine whether there is a possibility of developing something superior to the numerous standard dynamites already available. High-grade gelatin dynamites appear to be about the best that are now to be had.

Of interest is the substantial increase in consumption of black powder in pellet form. This product was put on the market in this country in 1926, chiefly to provide a safer and more convenient form of black powder. Pellet powder pound for pound is stronger than the granular black powder. To meet the increased demand for pellet powder, it has been necessary for many of the black-powder plants to be equipped with the necessary machinery and buildings for handling it.

Nitric Acid Manufacture Improved

DOUBTLESS the most important development during the last few years has been the adoption by explosives manufacturers in the United States of the new process for manufacture of nitric acid—namely, by the oxidation of ammonia. Nitric acid is a raw material of major importance in the manufacture of explosives. It is used in making nitroglycerin and ammonium nitrate, the two materials which make up the bulk of the explosive strength in dynamites. The first plant for manufacture of nitric acid by the new process was put into operation in 1927. It produced part of the requirements of one of the large dynamite plants in the country. Other ammonia oxidation plants were started in 1928 and still others were placed in commission during 1929. These plants require the investment of millions of dollars. This development, including the manufacture of ammonia from nitrogen in the air, was initiated and promoted by one of the large dynamite companies. Every effort is being made to see that not only the explosives industry but the country as a whole benefits by it.

In the blasting supply field the transition from the use of caps fired by fuse to the electric type of blasting cap continues. Use of tetryl blasting caps, which were put on the market three years ago, has become extensive, and the satisfactory performance of these caps as compared with the old-fashioned fulminate caps has shown that a definite advance has been made. Tetryl is an organic explosive which is very much stronger than fulminate of mercury. It is made entirely from materials available in this country, whereas the bulk of the mercury necessary for making fulminate has to be imported from Spain.

New delay electric blasting caps were put on the market in 1929. These are a great improvement over the old delays, inasmuch as they are very much shorter, particularly those of the longer intervals, for example sixth to tenth. These are now available up to and including the tenth delay. Because of the short length and regularity of timing they are finding increased usefulness.

A new electric squib for use with pellet powder was developed. Those on the market at the time pellet powder was introduced were designed for igniting the granular type of explosives. Pellet powder is provided with a central cylindrical hole in which it is convenient to place the squib. With the old type of squib the flame shot out from the end of a tube parallel to the axis of the hole in the pellet and considerable trouble was experienced with the failure of the pellets to be ignited. The new squib consists of a metal shell which contains the ignition powder, the flame from the burning powder being directed out of the shell and directly against the side wall of the perforation in the pellet by means of two holes in the metal shell near the bottom end.

An Improved Blasting Machine

A POWERFUL new blasting machine has been developed. This was designed by research engineers of the General Motors Corporation after they had examined and tested nearly every type of existing machine. A special study was made of the merits of shunt-wound and compound-wound dynamos, but after exhaustive tests the original winding in series was adopted, with a number of modifications for which patent application has been made.

Among the new electrical features of this machine are a two-point clutch which enables the current to be sent out on the firing line at its peak; a laminated armature and solid core field for building up the maximum current; a 1-microfarad condenser to store up the current until the moment of discharge; and, most important of all, a new eight-point breaker of unique design which utilizes the current heretofore wasted in the large spark at the completion of the stroke.

The mechanical improvements consist in placing the field windings so as to

improve the efficiency of the machine; in use of ball bearings on the armature shaft; and in a thrust bearing for the rack bar which is in the direct line of thrust instead of being offset as formerly.

The machine has a rated capacity of 100 caps, but this rating is very conservative, as one cap has been fired through a resistance of 550 ohms and 15 caps have been fired in parallel. It has been exhaustively tested in the field and on numerous occasions has fired as many as 125 holes connected in series. Assembled, it weighs a little less than 36 lb., being only a trifle larger than the old du Pont No. 3 30-hole machine, although it is stronger than the No. 5 or No. 6.

Another Maker's Slant

CONTINUED studying of the performance of explosives in field and laboratory and the strict chemical control of their manufacture promoted the efficiency of all types and introduced several new explosives during 1929, according to officials of another company in this field, namely the Hercules Powder Company. This manufacturer announced three new explosives. Two were very high-count permissible explosives for the coal industry. In pioneering their development the company believes it has made an outstanding contribution to the coal industry in that the two explosives have successfully filled the gap where the field previously seemed closed to permissibles.

In other fields, also, it states, economies were effected for users of explosives during the year. Its Hercomite series of high-ammonia explosives, intended to afford relative safety and economy, were widely adopted for mine and open-pit operations. The smoke and fume characteristics of this type of powder were further improved so that they compare very favorably with the gelatin dynamites and are readily adaptable to either surface or underground work.

The third new explosive was a semigelatin dynamite combining the economical feature of high-ammonia content explosives with the more plastic and water-resisting characteristics of gelatin. This company also produced a ten-cap blasting machine. After long experimentation, a pocket-size blasting machine of the dynamo type was perfected, which represents the latest practice in American electrical machine design. Its outstanding features are that it weighs only 4¾ lb.; has dynamo generation; has an even, practically nonpulsating current and a substantial reserve of power over its rated capacity to fire ten electric blasting caps.

According to the latest announcement of this company, new developments in blasting machine design have practically eliminated the necessity for oiling the bearings. Manufacturers of the one to fifty hole blasting machine have installed an armature shaft of special porous bronze, impregnated with graphite. During assembly a little oil is put on this shaft, and thereafter for the life of the machine the bearing is self-lubricating. Troublesome oil cups have been eliminated, and the only oil now necessary to the blasting machine is a very small quantity occasionally applied externally to the rack bar.

Owing to the advances made in the explosives manufacturing during the past few years, freezing is no longer a problem, there being few modern dynamites which will not withstand temperatures ordinarily encountered. Research and experimental effort continue to be expended in the quest for still greater efficiency and uniformity in standard dynamites, gelatins, and permissibles which are widely used in coal, metal, and non-metallic mining.

This Lining Rubber Resists Abrasion Remarkably—Other Products

THREE rubber products that have application in mining and milling have interesting qualities. One of these is a form of elastic rubber which has high resistance to abrasive wear. In various tests it is said to have outworn hard steel more than ten times. It was developed in the laboratory of the B. F. Goodrich Rubber Company, Akron, Ohio, and bears the name of Armorite. It is being applied in sheets of various thicknesses for lining chutes, hoppers, and other wearing surfaces in connection with handling ore, sand, gravel, and similar materials; also as a lining for sand suction hose and for dredging sleeves and in making rubber-lined pipe.

A sand and gravel plant near Pittsburgh reports that it has used this material as a chute lining for an entire year, whereas the unprotected steel plates and chutes previously used had to be replaced every five or six weeks. The material has also proved advantageous in eliminating noise. Another report tells of its use in dredging sleeves handling millions of yards of sand and shell under 30-lb. pressure. The sleeve had been in use for 27 months, and the maximum wear at any point was less than three thirty-seconds of an inch. This rubber's remarkable toughness is said to be produced by using a special form of finely divided carbon in its manufacture.

The remaining two products are a new endless transmission belt and an improved air hose, both turned out by the Goodyear Tire & Rubber Company, of Akron. The belt, known as Compass, is genuinely endless, practically stretchless, 25 per cent thinner than other belts of equal power capacity, the makers say, and more flexible than fabric belt. Its transmitting qualities are obtained by using a core of strong inlaid longitudinal cords, which are entirely spliceless and carry the load. They are imbedded in rubber and are covered by an elastic rubberized fabric envelope which takes all of the surface wear and is biased to make it elastic and relieve it of strain, which is thereby thrown on the cords. The envelope is built with the longitudinal seam on the edge, thus providing two plies of fabric on the inner or pulley side and giving a double resistance to wear. Ply separation cannot occur, the makers assert.

This belt was designed to meet severe conditions sometimes met in driving short-center compressors where a heavy idler next to the driving pulley causes severe flexing action. The makers recommend it for mine fans where forced shutdowns would be costly and at times disastrous. It conforms readily to small pulleys and is sufficiently elastic for shock loads.

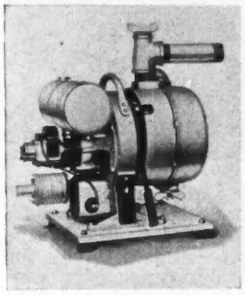
The air hose referred to is designed for long service under severe operating conditions. It has a heavy, tough cover which will resist the severest abrasion. The hose is of braided construction with a carcass of high tensile cords which give it strength and ability to resist extremely high pressure. The tube is heavy and of rubber that is able to resist the deteriorating effect of warm or cold lubricating oil. This hose is known as "Emerald Cord," and is made in lengths up to 50 ft. in ¾ in., 1 in., and 1¼ in. sizes.

Equipment Review

Two new models have been added to the line of Leadville single-drum air or steam hoist introduced by the Gardner-Denver Company, of Denver. These will have greater capacities than the three models previously announced. Design of the engine has been improved to increase its efficiency and retain the same power and speed forward or reverse. All moving parts are inclosed. Post brakes are used. One of the models is rated at 6 hp. with a rope pull of 2,000 lb., at a speed of 150 ft. per minute. The drum is 6 in. in diameter by 9¼ in. wide, and will hold 620 ft. of ⅜-in. rope. This model is No. 8. The five hoists range in capacities from 1,000- to 2,500-lb. rope pull.

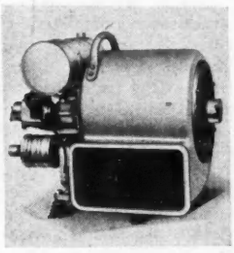
New Portable Equipment

A varied line of improved portable equipment has been announced by the Homelite Corporation, of Port Chester, N. Y. It includes three pumps: One is a self-priming unit weighing 95 lb. and having a built-in 1½-hp. air-cooled gas engine. It will handle 7,500 g.p.h. The



A portable self-priming centrifugal pump driven by 1½ hp. motor

second is a centrifugal pump with a built-in engine of similar type and of 7,500-g.p.h. capacity. It will lift up to 20 ft. and weighs 95 lb. The remaining pump is a self-priming centrifugal type,



This portable blower, gas-engine-driven, is good for 2000 cu.ft. of air per minute

weighing 135 lb., direct-connected to a ½-hp. motor, and has 7,500-g.p.h. capacity. The company has also introduced a portable blower weighing 75 lb. and of a capacity of 2,000 cu.ft. per minute, with a built-in 1½-hp. gasoline engine, and a portable gas-engine-driven generator weighing 110 lb. and rated at 110 volts, 32 volts d.c., 600 watts.

For Treating Gold Sands

The Evans-Stephan Corporation, Ltd., of Petaluma, Calif., is preparing to manufacture and distribute a gold-saving unit for treating gravels and black sands. The unit consists of a hopper the bottom of which is a punched plate screen, 22x30 in. in size. Hopper and screen are given a reciprocating motion, the oversize being discharged over a low dam at the end of the screen into a launder.

Water is showered over the screen. The undersize is received upon a hopper-shaped launder, with riffled surface and distributed in an even sheet to a table, the slope of which is adjustable. The table is 16 in. wide and 5 ft. long. The bottom board is of specially treated maple in which a system of diagonal grooves, ¼x¼ in., connect to a center groove which leads to a cleanup opening at the lower end of the table. Superimposed over the maple board but separated from it by a space ⅛ in. high is an iron grating, the transverse bars of which are ⅜x⅜ in., 2½ in. apart. This serves to break up the flow of sand and water. The overflow at the pointed end of the table is restrained by a low dam 1½ in. high.

Cleanup of the table is intermittent. A 3-hp. gasoline engine drives the screen. The unit is estimated to have a capacity of 25 cu.yd. per eight hours.

New Facilities for Research

Expenditure of $1,500,000 will be made by the Westinghouse Elcetric & Manufacturing Company in building of a central engineering laboratory, eleven stories high and 80x225 ft. in dimensions, and a 125-ft. extension to the present direct-current power laboratory, both in East Pittsburgh, Pa. According to F. A. Merrick, president of the company, the buildings will house one of the world's best-equipped electrical laboratories. The new unit will eventually replace numerous smaller laboratories and experimental test sections now scattered throughout the plant, in keeping with the tendency toward consolidation, and will provide additional facilities. Laboratories under one roof and under centralized supervision will facilitate development work.

BULLETINS

Switches—Monitor Controller Company, Baltimore, Md. Bulletin No. 115, describing automatic magnetic-reversing printing-press controller and dynamic braking for d.c. motors.

Laboratory Equipment — Denver Equipment Company, 1419 17th St., Denver, Colo. Leaflet announcing some new developments in laboratory equipment.

Motors — General Electric Company, Schenectady, N. Y. Bulletin GEA-1172, describing super-synchronous motors for large grinding and pulverizing mills.

Welding—The Lincoln Electric Company, P. O. Box 683, Cleveland, Ohio, has issued a series of leaflets on studies in structural welding.

Generators—Troy Engine & Machine Company, Engberg Division, St. Joseph, Mich. Bulletin No. 106, describing improved generating sets for stationary service, direct current, two or three wire.

Rolls—Hadfields Ltd., East Hecla and Hecla Works, Sheffield, England. Bulletin No. 304, Nov., 1929, describes high-speed and other types of crushing rolls for the reduction of stone, ore, and other materials.

Turbine-Generators — Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Pamphlet No. 20378, includes material on the general features and construction of the new 25 to 50 kw. d.c. geared turbine-generator sets.

Instruments—Adam Hilger, Ltd., 24 Rochester Place, Camden Road, London, N.W. 1, England. Book entitled "The Practice of Spectrum Analysis With Hilger Instruments," including a note on the various types of emission spectra.

Roller Chain — Link-Belt Company, Indianapolis, Ind. Data Book No. 1257, a complete manual for properly selecting and applying chain.

V-Belt Drives—Allis-Chalmers Manufacturing Company, Texrope Division, Milwaukee, Wis. Booklet on Texrope drives, showing the application of this transmission to almost every industry.

Motor Equipment—General Electric Company, Schenectady, N. Y. Bulletin No. GEA-834A, describing CR7764-C1 and CR776-B1 controllers for wound-rotor, a.c. induction motors.

Metallurgical Analysis—Adam Hilger, Ltd., 24 Rochester Place, Camden Road, London, N.W.1, England. Book entitled "Spectrographic Outfits for Metallurgical Analysis," a guide to the choice of suitable spectrographic apparatus for a technical laboratory.

Welding—The Lincoln Electric Company, Cleveland, Ohio. Specification Bulletin No. S-1935A, describing the company's "Stable-Arc" welder of stationary platform type.

Starters—General Electric Company, Schenectady, N. Y. Bulletin No. GEA-416B. CR7051 automatic starter compensators for squirrel-cage induction motors, two- and three-phase.

Compressors—National Brake & Electric Company, Milwaukee, Wis. Bulletin No. 852, describing types "WN-C110" and "WN-C165" portable engine-driven air compressors.

Locomotives—Milwaukee Locomotive Manufacturing Company, Milwaukee, Wis. Bulletin No. 160, describing types "J-4" and "J-4½" gasoline locomotive.

Generators—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Leaflet No. 20414, describes the application, features, and construction of the Type QS generators developed to meet the requirements of steam and internal-combustion engine drives.

Turbine Pumps — Layne & Bowler, Inc., Memphis, Tenn. Catalog entitled "Well Water Systems and Vertical Turbine Pumps."

Compressors — Ingersoll-Rand Company, 11 Broadway, N. Y. C. Bulletin describing new Type 30 two-stage, air-cooled, ball-bearing compressors.

Bending Machines—Wallace Supplies Manufacturing Company, 1310-12 Diversey Parkway, Chicago, Ill. Bulletin No. 26, which describes hand and power bending machines.

Valves — Merco Nordstrom Valve Company, 343 Sansome St., San Francisco, Calif. A new catalog featuring valves in the various sizes with pressures ranging from normal to 1,500 lb. Also a larges number of mechanical detail drawings.

Industrial Notes

Sullivan Machinery Company has established a branch office at Johannesburg, Transvaal. Charles C. Smith, of the Sullivan staff, will be manager of the new office.

Stephens-Adamson Manufacturing Company has recently established a new engineering and sales office at 521 Skinner Building, Seattle, Wash. C. J. Horn, formerly assistant chief engineer for the firm, will be in charge.

Brown Instrument Company, of Philadelphia, announces the appointment of E. B. Nichols as chief engineer.

Dings Magnetic Separator Company has appointed G. A. Reinhard as representative in the Cleveland territory.

NEWS OF THE INDUSTRY

Summary

United Verde has started work on the new shaft that it will put down at its mine, Jerome, Ariz., to replace Nos. 5 and 6 shafts, damaged by ground movement. The new shaft will take three or four years to complete to 3,000 ft.

* * *

Opposition has arisen to the proposed merger of Robinson Deep and Village Deep, on the Central Rand, Transvaal, by Village Deep stockholders. The deal calls for sale of the Village Deep properties for £337,500.

* * *

Two power plants are proposed for the Pend Oreille River, in British Columbia, to supply mines in the vicinity. Reeves McDonald and West Kootenay are the companies applying for rights.

* * *

Silver King Coalition, at Park City, Utah, will drive a 7,000-ft. tunnel to develop the adjoining Silver King Western property, controlled by the same interests.

* * *

Bwana M'Kubwa will develop the Mimbula orebody at its N'Kana property, in Northern Rhodesia, so as to have two mines to draw on for the 5,000-ton mill that will be constructed.

* * *

Reasons for his proposal of a 30c. tariff on imported silver are offered by Senator Key Pittman, of Nevada, in a public statement on the silver situation, which demands drastic action, he avers.

* * *

Shattuck Denn Mining will start extraction of ore from the Ophir orebody in the Denn mine, at Bisbee, Ariz., about March, when production will probably show another increase.

* * *

Installation of a new pumping plant at the Tintic Standard silver-lead mine, at Dividend, Utah, will involve using churn-drill casing for pipe column. Plant will handle 600 g.p.m. from 1,450 level.

Prepare Plans for Precious Metal Unit at New Ontario Copper Refinery

DESIGNS are being prepared for a unit to treat slime containing precious metals precipitated in the process of refining International Nickel blister copper at the new Ontario Refining plant, being built at Copper Cliff, Ont., by International Nickel, American Metal, and Consolidated Mining & Smelting. Ores of the Sudbury district, particularly those from the Frood mine, contain substantial amounts of gold, silver, and platinum-group metals in addition to nickel and copper. In treating these ores, the platinum-group metals tend to separate with the nickel, and the gold and silver are generally found with the copper. Gold and silver will consequently be the chief precious metals recovered in the new unit, although some platinum and palladium will also be refined. Other platinum-group metals, such as osmium and iridium, will be shipped to the International Nickel plant at Port Colborne for refining. The new unit will be built east of the electrolytic section of the refinery.

With about 800 men engaged on construction work, the refinery, on which work was started last May, is now half completed, according to C. H. Aldrich, manager, and one section will be ready to start by mid-summer. Steel work is about 75 per cent completed. The electrolytic cell building is finished; heating units, consisting of six Sturtevant fans, are operating and most of the foundation piers for the cells are in place. About 3,500,000 lb. of antimonial lead is on order from the Hoyt Metal Company of Canada, and is being delivered for lining the cells and pipes. The sectional concrete cells, 1,200 in number, are being assembled. Of these 300 are in place and 150 fully lined. Six cell-house electric cranes are in operation and foundations for the power-house units are going in. These consist of three 2,000-kw. Canadian General Electric motor generators and a large Goldie & McCullough compressor, to be delivered next month.

Work on the pig storage building is practically completed. The anode storage building is half completed and the anode casting steel one third completed. Work has started on the wirebar casting building. A start is being made on the first anode furnace and on the installation of waste-heat boilers. The machine shop building is fully erected and foundations are in place for the pulverized-coal building.

No fundamental changes in plans or design of the refinery have been made since construction started. Initial capacity will be 10,000 tons per month. Mr. Aldrich says the company is ready to increase this capacity and double it if necessary at such a time as a larger supply of blister copper is available. Up to the present, no definite arrangements have been completed for blister other than that of International Nickel.

■ ■ ■

Lake View & Star May Build Central Power Plant

Possibilities of constructing a central power plant, using oil for fuel, are being investigated by Lake View & Star, gold producer at Kalgoorlie, Western Australia, according to J. A. Agnew, in a statement made at the annual meeting of the company in London on Dec. 30. At present the company, which holds several separate mines, maintains individual power plants at each mine. As an alternative to construction of a central power plant, the company may use electric power from the Kalgoorlie Power Company, thus obviating capital expenditure.

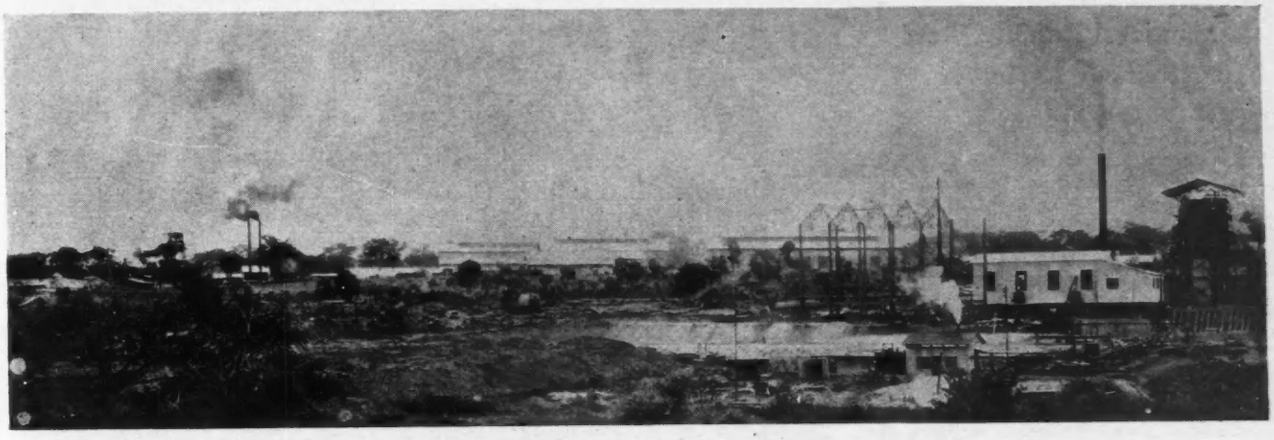
The most recent development in the Chaffers section from the Golden Horseshoe workings is a drive south on the No. 4 lode at the 3,140 level. The first 51 ft. averaged 316s. per ton for a width of 6 ft., Mr. Agnew stated. A slide at the end of that distance was encountered and the grade dropped. Development on the 2,770 and 2,900 levels in this section has been highly satisfactory.

After repeated tests with the flotation process as a means of treating the ore, the Lake View & Star management has decided to proceed with construction of the first unit of a flotation plant. This unit will have a capacity of 5,000 tons of ore monthly, and equipment for it has been shipped to Kalgoorlie. If results confirm the preliminary test work, additional units will be constructed until the plant has a total capacity of 40,000 tons monthly. During 1929, the company treated a monthly average of 7,500 tons of its own ore and 5,000 tons of ore from leasing operations in its old plant.

■

Curtail at Castle-Tretheway

As a result of the low price of silver, Castle-Trethewey, at Gowganda, Ont., will make a substantial cut in its exploration program. For the last three years, the company has been doing 1,000 ft. of exploratory work monthly, and this has represented at least one-third of total costs per ounce of silver produced. Production for 1929 is expected to be about 100,000 oz. of silver less than in 1928, when 951,718 oz. was produced. Costs are estimated at about 40c. an ounce. During 1930, profits are expected to be about half of those for 1929.



The site of Roan Antelope's 5,000-ton concentrator, in Northern Rhodesia, as it appeared in mid-November

Apply for Two Plants to Supply Power to British Columbia Mines and Smelter

West Kootenay Plans Development of More Than 180,000 Hp. on Pend Oreille River—Reeves-McDonald Project Calls for 9,000 Hp. for Mine and Concentrator

TWO applications have been submitted to the British Columbia Water Board involving construction of hydro-electric plants on the Pend Oreille River which will furnish power to mines and metallurgical plants in the Kootenay and Pend Oreille districts. West Kootenay Power & Light has applied for permission to build a plant that will develop not less than 180,000 hp. and up to 370,000 hp. and will cost $18,000,000. This plant will furnish power for the new unit of the Trail electrolytic zinc plant and the fertilizer works under construction by Consolidated Mining & Smelting, which is the parent company of West Kootenay Power & Light. The other application was made by Reeves-McDonald Mines and asks for a plant to supply 9,000 hp. to its mine in the Pend Oreille district.

The two applications impinge on each other to a certain extent. Construction of a 350-ft. dam at a point near the fork of the Pend Oreille and Columbia rivers by West Kootenay would flood the proposed site of the Reeves-McDonald dam. Col. H. H. Yuill, president of Reeves-McDonald, states that so urgent are the immediate power needs of his company, which is developing a large low-grade zinc mine, that it is willing to guarantee no action for damages against West Kootenay should the latter build its plant and flood the Reeves-McDonald installation. Building of the West Kootenay plant will take from three to four years, and in the interim the Reeves-McDonald plant could be brought into operation. The Water Board has reserved decision on the Reeves-McDonald installation until Aug. 31, if West Kootenay has not filed its plans by then.

Reeves-McDonald originally intended to ship its ore, averaging about 7 per cent zinc, to Pend Oreille Mines & Metals, which has announced its intention of building a 2,000-ton concentrator and electrolytic zinc plant on the United States side of the boundary. The two companies are closely allied financially. However, the proposed amendment to the tariff bill now being considered in the United States Congress, calling for a tariff on ores containing less than 10 per cent zinc, would make shipments into the United States impractical. At present no duty is paid on low-grade zinc ores. Should the bill pass, Reeves-McDonald will probably build its own concentrator in British Columbia.

Reeves-McDonald has struck the orebody in its bottom tunnel at a depth of 1,100 ft. and 3,300 ft. from the portal. A drift has penetrated the ore for 70 ft. No sampling has yet been undertaken, but appearances indicate ore of a grade about the same as that developed in the upper tunnel, where drifting has shown 1,000 ft. of ore, 32 ft. wide, averaging 6.6 per cent zinc, 1.7 per cent lead, and some silver.

■

Paradise Mine Closed

Victoria Syndicate has shut down the Paradise mine, near Invermere, B. C., which it has been developing under lease and option for more than two years. A 75-ton pilot mill was erected on the property, and about a year ago the syndicate announced its intention of building a larger mill on a flat 4 miles from the mine and connecting mine and mill by a cable tramway.

■

Timmins Safety Station Ready

The first of three new rescue stations to be opened by the Ontario Department of Mines at Timmins, Kirkland Lake, and Sudbury has been completed and is ready for use at Timmins. Fire-rescue crews of five men each are now being trained. The station is under the charge of Austin Neame, formerly first-aid officer at McIntyre Porcupine. It was built and equipped for about $10,000, supplied jointly by the Workmen's Compensation Board and the mines. Equipment includes twelve sets of breathing apparatus, twelve all-service gas masks, one H-H inhalator, three monoxide detectors, and a complement of self-rescuers.

General Development Negotiating for Birch Creek Area

Negotiations for a lease on the property of Crown Dredging & Mining at Birch Creek, Alaska, are being conducted by General Development and Gold Fields American Development. The property consists of 5,500 acres of placer ground, on which a large yardage has been proved, average depth being from 18 to 22 ft. Present plans call for installation of a dredge for each 10,000,000 cu.yd. of gravel proved. A. J. Baumgartner, of Seattle, is president of Crown Dredging and T. V. Reeves, of San Francisco, is mining engineer.

■

Dome Awaits McIntyre Results

Dome Mines is awaiting results of operations at McIntyre Porcupine's pilot mill, which is testing new gold-ore treatment methods evolved by McIntyre engineers, before proceeding with plans for rebuilding its mill at Porcupine, Ont., destroyed by fire on Oct. 28 last. Tentative proposals for using part of Hollinger Consolidated's excess mill capacity to treat Dome ore have been practically abandoned, according to reports. Work of cutting down and clearing away ruins of the old mill has started and a new plant will probably be built in the spring. If the new plant is built, its capacity will probably be the same as that of the old one—1,500 tons daily—as this is considered an ideal tonnage for Dome's underground facilities.

■

High Grade at Kirkland Lake

Development work on the orebody at the 3,875 level of Kirkland Lake Gold, in the Kirkland Lake district, Ontario, has shown 60 ft. of high-grade ore over a width of 6 ft., with both faces in ore. This is the deepest ore development that has taken place in the Kirkland Lake camp. The shaft, which has been continued to the 4,000 level, has been completed at that depth and a crosscut south has just reached the continuation of the orebody.

Ore developments at the 3,875 level are reported to be remarkably similar to those obtained on the 2,950 level of the adjoining Teck-Hughes property. The orebody apparently occurs in three sections, separated by considerable vein matter, with the total width of the vein ranging from 70 to 80 ft.

Senator Pittman Offers Remedy for Silver

DECLINE in the price of silver has evoked the following statement from Senator Key Pittman, of Nevada, who is proposing a 30c. tariff on the metal:

"The critical situation in regard to silver is being discussed in the press of the world. According to the Director of the U. S. Mint the price of silver is now the lowest in history and the silver dollar is only worth 35c. The Spanish peseta is down to about 50 per cent of its par value. In Mexico, South America, and India do we find the same situation with regard to silver money?

"In China, where silver is used almost exclusively as a circulating medium, the unprecedented drop in the price of silver has resulted in a proportionate increase in commodity prices and a crisis has been reached. According to editorials of the New York *Times* and financial papers it is alleged that this situation is caused by an oversupply of silver due to the demonetization of silver and the establishment of gold standards in various countries.

"This is undoubtedly true. It is not true, however, that there is an overproduction of silver in the sense of new production. While the supply of silver in the world for market purposes has increased by the cessation of its use as a money medium, the production from mines of new silver has for years been, and is now, steadily decreasing. The production of silver in the United States has decreased from 73,000,000 oz. in 1923 to 59,000,000 oz. in 1929. During the last two years the production of silver in Colorado, Arizona, and Nevada, where the great silver mines of the United States are situated, has decreased from 20 to 25 per cent.

"The question is one of international concern. It is one of grave concern in the United States during this period of increasing idleness of labor. Silver mines throughout the West are steadily closing down and thousands of men are being added to the horde of unemployed. Farming communities and towns that have been dependent upon such employment are becoming bankrupt.

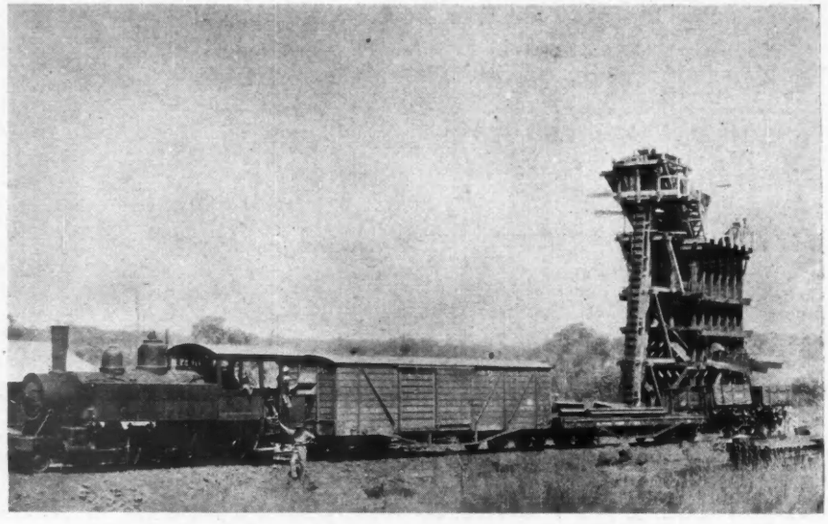
"Is there any remedy for this condition in the United States? It is the duty of our government to solve this question at once. There are several hundred producing silver mines in the United States, and their existence is being threatened. There is one remedy that would certainly free the United States to a great extent from such panic; that is, an embargo upon the importation of silver, except for the purpose of reduction, refining, and export. This is a drastic measure and the government may hesitate to undertake it, but the conditions seem to require drastic measures. This country has adopted the embargo before. During the war it placed an embargo upon the exportation of both gold and silver.

"Silver, heretofore used as money throughout the world, by reason of a change to a gold standard is being dumped upon the market of the world. It is destructive of the monetary systems of those countries that still use silver chiefly as money and is not founded in international monetary science or in a just regard for world conditions. This silver is also being dumped in the United States, to the destruction of our silver-mining industry.

"This condition, as far as the United States is concerned, can be alleviated by a tariff duty on the importation of silver. Under normal conditions such a tariff is justified and under the present conditions it is obligatory. This country consumes annually 40,000,000 oz. of silver, while its production is approximately 59,000,000 oz. There is imported, duty free, from Mexico and South America 100,000,000 oz. annually to compete with American-produced silver for the American consumptive market of 40,000,000 oz.

"The average wage in the silver mines of the United States for miners is $5 a day for eight hours. The wage for the same labor in Mexico and South America is approximately $1.50 a day. The average increase of all commodity prices in the United States since 1913 is approximately 35 per cent, while the wholesale price of pure silver has decreased over 29 per cent.

"I have pending a proposed amendment to the tariff bill providing a duty of 30c. an ounce upon the importation of silver. If this amendment is adopted, the dumping of foreign silver into the United States will be retarded and the producers of American silver will be allowed to compete in the United States market upon a living basis."



At Roan Antelope, in Northern Rhodesia—the rock crusher for preparing concrete material

■ ■ ■

United Verde Starting Work on Sinking of New Main Hoisting Shaft

WORK has been started on the new main hoisting shaft that United Verde Copper will sink at its underground mine in the Jerome district, Arizona, to replace Nos. 5 and 6 shafts. Drifts are now being advanced on the various levels between 300 and 3,000 ft. to the shaft site. When it is reached, raises will be put up between these levels and enlarged to shaft size. This new opening will cost between $2,000,000 and $3,000,000. Its collar will be in the vicinity of the Verde Tunnel & Smelter depot on the 300 level. Both ore and supply hoists will be on the surface. A change room will be established west of the park on the 300 level.

Ground movement, which reached severe proportions last July, affected the area around Nos. 5 and 6 shafts to the extent that a new hoisting unit became imperative. Until the new shaft is complete, very little mining will be done above the 1,650 level, because of the danger of further movement. Working at a depth of 3,000 ft., the United Verde is the deepest operating mine in Arizona. Probably the new shaft will ultimately go below 4,000 ft.

To sink the new shaft the company will have to move one of the waste dumps from steam-shovel operations, estimated to contain 600,000 tons of material. The time required for this work and for sinking the new shaft will be about three years.

United Verde produces about 40 per cent of its total ore from the underground operations at present, but this proportion will gradually increase as work at the open pit approaches the depth to which it can be economically carried.

■

Change Sunrise Mine to Caving

Colorado Fuel & Iron has adopted the caving system of extracting ore from its Sunrise mine, in Wyoming, and, as a result, 138 miners were laid off on Jan. 1, since a smaller crew can now handle the work. About 40 miners were laid off late in the fall. However, the company is advertising for miners experienced in the use of caving methods to augment its depleted forces.

■

Dickens Con. Stops Operations

Production of lead and zinc concentrates from the 200-ton mill of Dickens Consolidated, in the Coeur d'Alene district, Idaho, has been suspended, and all work in the mine has ceased. Low prices for zinc and silver, and the difficulty of finding a market for the zinc concentrate, caused the shutdown. Pumps will be kept in operation, however, and the mine will be able to be put on a producing basis within 24 hours should occasion warrant, according to Guy Riegel, president of the company.

M. A. Hanna Takes Over Several Lake Superior Properties

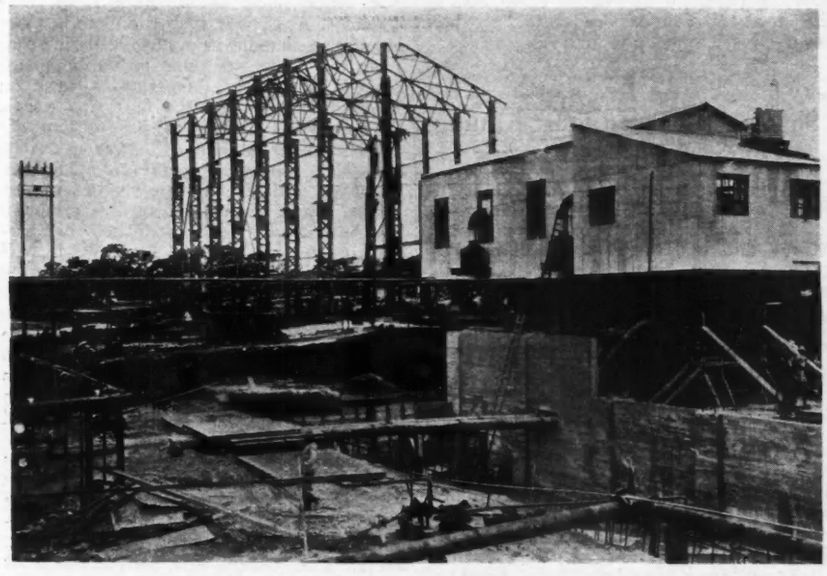
The M. A. Hanna Company, acting for the newly formed National Steel Corporation, has acquired several properties in the Lake Superior iron districts. These include the remaining unleased properties of Great Northern Ore, on the Mesabi Range; all the properties of Northern Pacific Railway, on the so-called "South Range" section of the Cuyuna Range; the Crosby mines, including the Portsmouth, Meacham, Martin, and Huntington properties, all on the Cuyuna Range; holdings of Florence Iron, in Michigan and Wisconsin; and an option on 10,000 acres of land in the Menominee district of Michigan. Drilling has been started on this tract. Drilling is also under way on a 3,000-acre area on the Gogebic range, which the Hanna interests are exploring with Inland Steel.

Silver King Starts Driving New Tunnel, 7,000 Ft. Long

Driving of a 7,000-ft. tunnel, an extension of the Spiro tunnel, has been started at the property of Silver King Coalition Mines, at Park City, Utah. The new tunnel, which will have a section of 10x8 ft., will penetrate the adjoining Silver King Western property, controlled by the same interests as Silver King Coalition, to facilitate its development.

According to Fred Johnson, contractor, S-70 Ingersoll-Rand drifters, 4½-in. mountings, and 42-in. guide shells will be used for drilling operation. All shoveling will be done mechanically with a compressed-air Nordberg Butler shovel. Compressed air for operations will be supplied from the new compressor plant recently installed at Silver King Coalition.

■



Power plant and pump-sump construction at Roan Antelope, Northern Rhodesia

■

St. Joseph Lead Building Mill at Sylvia Lake Property

Construction of a 500-ton concentrator at the Sylvia Lake property, in St. Lawrence County, N. Y., is being completed by St. Joseph Lead. The property was acquired by the company about four years ago. Drilling indicated an orebody carrying chiefly zinc, with a small amount of lead. The company's Edwards mine, which produced about 23,000 tons of zinc concentrate in 1929, is only 11 miles away.

■

Water Hampers Constitution

A large flow of water, struck in sinking the shaft from the 600 to the 800 level at Constitution Mining & Milling, in the Coeur d'Alene district, Idaho, has delayed the work of opening up the orebody at the deeper horizon. Pumping equipment adequate to handle the volume has now been installed, however, and sinking will be resumed about Feb. 1. Development of the oreshoots on the 600 level has been extremely satisfactory, a combined length of 574 ft. in the north and south drifts having been attained, with ore in both faces. The work has borne out a theory advanced by W. P. White, manager of the company, to the effect that with depth the oreshoots in the area south of the shaft would merge into a continuous orebody. The Constitution mill is now operating three shifts and handling about 150 tons daily.

■

Quincy Pushing Development

Almost 2,000 ft. of development work was done by Quincy Mining at its property in the Michigan copper district during December. Results of this work are stated to have been satisfactory. The showing in No. 8 shaft area is particularly satisfactory, as the tonnage developed was larger than in any previous month. The remodeled hoist at No. 6 shaft, work on which was completed recently, is working smoothly.

■

Unwater Canisteo Cliffs Mine

Two pumps, each having a capacity of 7,000 g.p.m. and driven by a 600-hp. 2,300-volt motor, have been placed in operation at the Canisteo Cliffs iron mine, formerly operated by Oliver Mining, on the Mesabi range near Coleraine, Minn. The pumps were manufactured by Allis-Chalmers. Water is pumped through 18-in. pipes over the south bank of the pit and empties into a ditch leading to Trout Lake and on into the Swan and Mississippi rivers. In spite of the combined capacity of 14,000 g.p.m. of the two pumps, estimates place the date when unwatering will be completed at Sept. 1. The pit is estimated to hold 2,500,000,000 gal. of water and the pumps are operated only twelve hours a day. The mine will probably not be ready to produce until May, 1931.

■

Utah Section Hears Talks on Steam, Power, and Iron

The Utah section of the A.I.M.E. held its regular monthly meeting at the Newhouse Hotel, Salt Lake City, on Jan. 9, J. A. Norden presiding. C. T. Van Winkle, secretary, first read the annual report of the activities of the local section during 1929, and a financial statement, preceded by a paper, "Utah State Mine Taxation," by A. C. Dick.

The regular program, arranged by Otto Herres, of the U. S. Fuel Company, chairman, then followed. Two interesting papers were read—namely, on "Production of Steam and Power," by C. P. Kahler, electrical engineer, Oregon Short Line Railroad, and "Operations of the Columbia Steel Corporation," in which the company's financial structure, blast-furnace practice, and the plants at Provo, Utah, and Torrence and Pittsburg, Calif., were described by W. R. Phibbs, general manager of the Provo unit.

■

Drill Area on Marquette Range

Pickands, Mather & Company has taken an option on the Conrad and Washington Iron lands at Clarksburg and Humboldt, on the Marquette iron range in Michigan. This area will be tested for hard ore, which has been in demand for the last few years. A contract for diamond drilling has been let.

■

Fellowships at Missouri School

In co-operation with the U. S. Bureau of Mines and the State Mining Experiment Station, the School of Mines and Metallurgy of the University of Missouri is offering four fellowships, open to graduates with the equivalent of a B.S. degree and the proper training in mining, metallurgy, or chemistry. Applications must be in before June 15. Further details may be obtained from the director of the school at Rolla, Mo.

■

East Utah Option Exercised

American Smelting & Refining has exercised its option on control of East Utah Mining and will begin development of the Park City (Utah) property at once. Prior to exercising the option the company made an extensive geophysical survey and geological examination of the property. Development work already performed comprises a 3,000-ft. tunnel and several crosscuts. Surface plant consists of a compressor plant, a blacksmith shop, and several other buildings. Diamond drilling at a later date will supplement underground development. Electric power for operations is purchased from the Utah Power & Light Company.

Tintic Standard Now Installing New Pumping Equipment

INSTALLATION of a new 600-g.p.m. pumping plant at the Tintic Standard mine at Dividend, Utah, as a safeguard in case a sudden flow of water is encountered, involves use of a churn-drill hole. According to M. D. Paine, chief engineer of Tintic Standard, installation of the new discharge pipe column in the small manway of the main two-compartment shaft of the mine was impossible because of air and water pipe lines that had been previously placed in the shaft. To avoid sinking a new pump shaft, involving considerable expense, the management decided to drill a 1,450-ft. churn-drill hole near the shaft, and to use the 24-lb. 8¼-in. diameter casing directly for the discharge pipe column.

Because the drill hole passed through a formation containing mineral matter of an acidic character, which would rapidly corrode steel pipe, the drill hole is 12 in. in diameter, with a 33-lb. 10-in. casing to a depth of 800 ft., to protect the inserted 8¼-in. casing.

Pump stations, each comprising a 4HST four-stage centrifugal Cameron of 600-g.p.m. capacity and an 800-ft. lift, driven by a 250-hp. motor, also a sump, will be installed on the 800 and 1,450 levels. Short crosscuts will be driven from these stations to the drill hole and casing.

At the 800 level, the 8¼-in. pipe casing is separated and a closed valve installed at this point. This valve and two pipe connections, welded on with the aid of a gas-welding apparatus above and below the valve, will divide the total head of 1,450 ft. into two stages. Water raised by the pump on the 1,450 level is discharged through the lower pipe connection into the 800 level sump, whence the station pump will convey it through the upper connection to the surface. Drilling and placing of the casings is being done by a drilling company on contract. The installation of pumping equipment is in the hands of the company's mechanical department.

■

Mining Death Rate at Record Low in Arizona During 1929

The per capita accidental death rate in Arizona mines for 1929 was the lowest in history, according to the annual report issued by T. C. Foster, state mine inspector. A total of 32 deaths from accidents occurred in Arizona mines during the year, compared with 29 deaths in 1928. The far greater average number of men employed in 1929 resulted in the lower per capita ratio. At the close of 1929, mines in the state employed 14,529 men, of whom 11,499 were underground workers and the remaining 3,030 surface employees, including those engaged in administrative duties.

■

Storm Delays Smelter Start

One of the worst snowstorms in the history of Yavapai County has delayed starting of operations at the remodeled Southwest Metals smelter, at Humboldt, Ariz., according to H. R. Lathrop, president of Sheldon Mining, which controls the smelting company. Plans had called for blowing in the smelter on Jan. 15, but the storm will delay this step at least a week. The plant has been completely re-equipped and its furnace capacity decreased from 500 to 250 tons of copper ore daily. It had been closed since late in 1926.

■

Shattuck Denn to Start Mining Ophir Area in the Spring

Production from the Ophir claim of the Denn mine of Shattuck Denn, at Bisbee, Ariz., will be started about March and will increase the company's copper output, now about 1,400,000 lb. monthly. Development work in 1929 proved the orebody in Ophir territory on the 1,800 and 2,000 levels. Calumet & Arizona has proved the same orebody in adjoining ground on the 2,200 level, and Shattuck Denn is now preparing to develop it at that depth.

Throughout 1929, production of copper ore from the Denn mine was increased gradually, until at present it averages about 400 tons of 5 to 6 per cent copper ore daily. No further increase over this tonnage is planned until mining of the Ophir orebody has started. Other increases may be effected later by opening up ground south of the shaft.

Production from the Shattuck mine has decreased considerably and shipments of lead ore have been suspended entirely. Prospecting in this property is continuing. Total production of the company in 1929 is estimated at 12,733,260 lb. of copper, compared with 5,149,716 lb. in 1928. December showed the highest output of any month, with an estimated total of 1,473,000 lb.

■

Magma vs. Minerals Separation Reaches Supreme Court

Hearing on the litigation between Magma Copper and Minerals Separation over flotation patents was conducted before the U. S. Supreme Court on Jan. 9. The case started in 1923, when Minerals Separation sued Magma for a violation of its so-called soluble frothing agent patent. At the end of four and a half years, a verdict was handed down by the Federal District Court of Maine, which heard the case, in favor of Minerals Separation. Subsequently the U. S. Circuit Court of Appeals reversed this decision, and Minerals Separation appealed to the Supreme Court. H. D. Williams presented the case for Minerals Separation and W. H. Davis represented Magma in the hearing at Washington.

Mine surface plant and mill at Monarch Lead

Monarch Lead Starts New Mill Near Chloride, Ariz.

OPERATION of the new 150-ton flotation plant of Monarch Lead, near Chloride, Ariz., was started on Jan. 1. The plant will handle complex lead-zinc ore from the Tennessee mine of the company, reopened last year. Operations were on a one-shift basis for the first two weeks. Storms, with consequent intermittent decreases in the amount of power available, have been hindering operations somewhat. However, with the tonnage handled to Jan. 19, the grade of the concentrates produced has been higher than indicated by preliminary testing, and the company is well satisfied with mill performance. Production is coming from the 900 and 1,200 levels.

A new 68-ft. steel headframe has been constructed at the mine, supplanting the old wooden structure. An Ottumwa double-drum electric hoist, handling ore in two-ton skips, has been installed. Two compressors, a 1,000-cu.ft. Ingersoll Rand and a 480-cu.ft. Sullivan, furnish air.

Equipment in the concentrator includes a Marcy ball mill, operating in circuit with a duplex Dorr classifier, driven by Texrope drive; Minerals Separation flotation machines; Dorr thickeners; and American filters. The concentrator, built at the shaft collar, is connected to the main Santa Fe line. The mill building is of sheet steel, with concrete floors and foundations.

■

Bancroft Discusses Rhodesia at Meeting of Canadian Engineers

Northern Rhodesia, with the Belgian Congo, is the largest metallogenetic area in the world in his opinion, J. Austen Bancroft, geologist for Rhodesian Anglo-American, stated at the monthly meeting of the Montreal section of the Canadian Institute. A year ago, Dr. Bancroft said, he estimated the tonnage that would be proved within five years at 250,000,000 tons of copper ore. Actually, development had shown 270,000,000 tons of ore in nine months. Now he estimates that within two years 2,000,000,000 tons of copper ore will be proved. Dr. Bancroft touched also on labor conditions, climate, topography, prospecting, and transportation in Northern Rhodesia.

■

Norwegian Pyrite Mine Closes

A strike of dock workers at Trondhjem, Norway, has affected operations at the Kjöli pyrite mine. On Jan. 2, miners were given two weeks' notice that the mine would close.

Tonopah Extension Output Up in Spite of Low Silver

Tonopah Extension, at Tonopah, Nev., shipped 26 bars of gold-silver bullion, weighing 52,610 oz., valued at $33,400, in the first fifteen days of January. This is an increase of $10,900 in value over the production for the last half of December. It results from the larger tonnage milled and the improved grade of ore handled. On the 1,200 level exploration has opened up some high-grade shoots and unofficial statements place the average grade of ore milled from this level at $50 a ton, in spite of the low price of silver.

■

Sproul Appointed to Head House Mines Committee

Representative W. H. Sproul, Republican, of Kansas, has been appointed Chairman of the Committee of Mines and Mining of the House of Representatives at Washington, succeeding Representative J. M. Robison, Republican, of Kentucky, who has become a United States Senator.

Mr. Sproul was born in Tennessee 62 years ago and has lived in Kansas for the last 46 years. In early life he worked in lead, zinc, and coal mines. He is a lawyer and has also engaged in the oil and gas industry. He has been in Congress for seven years, and opposed in the last Congress the bill authorizing appeals to the courts of war mineral claims now pending in the District of Columbia Supreme Court.

■

Work Lucas Manganese Tract

Development of the Lucas tract, near Leesville, Va., has been started by the Manganese Corporation of America, a Virginia corporation, headed by I. H. Rosenberg and associates, of New York. Two new shafts are being sunk on a proved deposit of high-grade manganese dioxide. Drilling also is reported to be under way.

■

Drill Area Adjoining Siscoe

Drilling operations have started on the Stanley Siscoe Gold property, adjoining Siscoe Gold, at Kenowisik Lake, in the Varson-Dubuisson section of northern Quebec. Sudbury Diamond Drilling has shipped four drills to the property, and a minimum of 10,000 ft. of drilling will be done through the ice of the lake.

■

Start on Junction Power Plant

Foundations for the new power plant for the Junction shaft at Bisbee, Ariz., have been completed by Calumet & Arizona. A 180-ft. stack is now being erected and structural supports for the boilers are being placed. The steam-electric plant will consist of two 750-hp. water-tube boilers, built by Combustion Engineering, and one 750-kw. steam turbine, with cooling towers. A new electric hoist will also be installed. At the smelter the anode plant, recently completed, cast 1,750 tons of copper anodes during December. The anodes are being shipped to the new El Paso refinery.

■

Bureau Potash Discovery in New Mexico Promising

One of the most promising discoveries of potash ever made in the United States was made in the last exploratory well just completed by the U. S. Bureau of Mines in Eddy County, N. M. The well was drilled to a depth of 1,080 ft., of which 515 feet were drilled without coring. The 565 ft. of core removed contains an unusually broad band of potash-bearing material. It is now being subjected to many mineralogical and chemical analyses.

Plans are being discussed for a continuation this summer of the co-operative studies of geophysical prospecting by the Bureau of Mines and the Dominion government of Canada. Under this plan each organization maintains its own identity, but field parties of each country include a representative of the other. In addition, there will be an exchange of all data gathered during the work.

■

Pittman's Silver Tariff Viewed Skeptically in Washington

Senator Pittman's proposal to protect the price of silver in the United States by imposing a tariff of 30c. per ounce on the silver content of ores, matte, and bullion is received with skepticism in Washington. Inasmuch as the United States is a silver exporting nation, with production far in excess of its own requirements, the futility of attempting to maintain a price in this country that is above the world market level by placing an embargo on imports is apparent to all those who have expressed any opinion whatever concerning the Nevada Senator's proposal. They point out that domestic producers would continue to compete for the domestic market, with the result that, with exportation always present as an alternative, the differential between the domestic price and the world price would soon be wiped out by sharp bargaining.

As the bulk of domestic silver is produced in conjunction with base metals, little likelihood exists that the supply will ever become so restricted that the tariff would be reflected in the price, its opponents declare. Aside from its disregard of economic law, imposition of a tariff on silver, assuming that any would be imported, would be very difficult and expensive to administer, they add. The burden on the government would be matched by the vexation caused to the smelters. Under the Pittman amendment, government samplers would be stationed at the smelters and government assayers would be appointed to report upon the samples to the customs collectors before liquidation of the import entries. In the present slump of silver prices Senator Pittman's proposal is expected to appeal to those producers who choose to disregard the traditional consequences of a change in legislation which might affect the law of supply and demand, but its enemies contend that the temporary relief, if any, afforded by an embargo on silver imports will intensify distress later.

Four Western Assay Offices Eliminated in Bill

Elimination of assay offices at Salt Lake City, Utah; Helena, Mont.; Boise, Idaho; and Carson City, Nev., after July 1 next, with a saving of $25,620, is provided by the Appropriations Committee of the House of Representatives in reporting the appropriations for the Treasury and Post Office departments. Total appropriations of $1,699,060 are made for the U. S. Mint service, a decrease of $40,980 from the current year and $25,620 less than the estimates. Appropriation for transporting bullion and coin between mints and assay offices is reduced by $15,630, as a result of a lessening of demand for gold coin for export.

■

Canadian Mine Stock Promoters Arrested on Fraud Charge

I. W. C. Solloway and Harvey Mills, partners in the firm of Solloway, Mills & Company, said to be the largest mining-stock brokerage firm in Canada, have been arrested on charges by the Attorney General of Alberta. These charges include bucketing, conspiracy to defraud, conspiracy to affect market prices of stocks, and gambling in stocks. The Manitoba government has announced that it will co-operate with the Alberta government and has started an investigation of the books of Solloway, Mills & Company and Stobie, Forlong & Matthews, in Winnipeg. No question of the solvency of these firms is involved, but their books are being investigated to determine if certain brokerage practices exist. The Ontario government is not taking any particular action at present.

■

Memphis Torpedo Mines Plans to Develop Organ Mountain Area

Formation of Memphis Torpedo Mines to develop and operate the Memphis, Torpedo, and Stephenson Bennett properties, in the Organ Mountain district, Dona Ana County, N. M., has been completed by a group of Boston financiers. These properties, extending for a length of 3½ miles on the main Organ Mountain contact, have been operated individually over a period of about 50 years and have produced about $3,000,000 in copper, silver, and gold. Plans of the new company call for unwatering of the three properties through a 2,000-ft. tunnel on the Stephenson Bennett property, and subsequent development work. There are several shafts on the three claims, the deepest of which are not more than 500 ft. deep.

A complete operating plant will be built on the Stephenson Bennett according to J. I. McCullough, of El Paso, Tex., who is vice-president and general manager of the property and who was instrumental in effecting the merger. Operations will also be conducted through the main Memphis shaft.

A Diesel power plant will probably be built, as estimates indicate cost of building a power line from Las Cruces would not be justified. Eventually the company plans construction of a mill and leaching plant. About 100 men will be employed when work on development is started. The company hopes to get under way within three months.

A close-up view of the concentrator site at Roan Antelope, Northern Rhodesia, showing some of the completed buildings

Resume Ore Shipments From Mason Valley Properties

Shipments of carbonate copper ore from the oxide zone in the Mason Valley mine, at Mason, Nev., have been started by leasers, operating under the supervision of Eastern Iron & Metal, a Salt Lake City machinery concern which acquired the mines, mill, and smelter of Mason Valley last year after they had been closed by the company. Two carloads of ore shipped by Fisher, Jenson, and Cole, the leasers, assayed 19 per cent copper, according to Morris Rosenblatt, manager of Eastern Iron & Metal. Arrangements are being made by the leasers to ship three carloads weekly. They have the first hundred feet of underground workings at the Mason Valley mine under lease. On the 400 level, Eastern Iron & Metal has developed a body of 13 per cent copper ore, and additional development will be undertaken at 570 ft.

At the Bluestone mine, Mr. Rosenblatt reports that about 75,000 tons of 3.6 per cent copper carbonate ore has been blocked out. This will be shipped to the Garfield smelter of American Smelting & Refining. Development in the sulphide zone has shown about 100,000 tons of 2 per cent copper ore, and if a sufficiently large tonnage is proved, resumption of operations at the 2,000-ton flotation plant may result. The smelter at Thompson will be dismantled.

■

C. M. & S. Stops Work at Mammoth

Consolidated Mining & Smelting is reported to have withdrawn its men and drilling equipment from the Mammoth property, in the Barren Lands of northern Saskatchewan, having completed the 5,000 ft. of diamond drilling called for in the agreement with Peter Davidson, owner of the claims. The company has until April 1 to decide whether or not indications warrant purchasing the property at the option price, $250,000 cash.

■

Safety Records at Hanna Mines

The M. A. Hanna Company, of Cleveland, operating extensive mining properties on the Minnesota and Michigan ranges, has added to its records of safe mining. To Dec. 1, the Homer and Richmond mines completed 23 consecutive months without a lost-time accident. The South Uno mine extended its record to sixteen months and the Maroco mine to thirteen months.

■

A.I.M.E. Annual Meeting to Be Held on Feb. 17-20

The annual New York meeting of the A.I.M.E. will be held on Feb. 17-20, according to a preliminary announcement, copies of which are now available from the Institute at 29 West 39th St., New York. Technical sessions will be held in the morning and afternoon of every day, except Tuesday morning, which will be devoted to the annual business meeting. The smoker will be held on Monday evening at the Hotel Astor, an informal dance will be given on Tuesday evening at the Engineering Societies Building, and the annual dinner will be at the Commodore on Wednesday evening.

■

Railroad Will Help Develop Belcher Island Iron Ore

Extension of the Temiskaming & Northern Ontario Railway to James Bay, the southern arm of Hudson Bay, will facilitate development and exploitation of the Belcher Island iron ore deposits of Northern Aerial Minerals Exploration. Premier Ferguson of Ontario recently announced that the railroad would probably be continued to the east side of James Bay. The N.A.M.E. plans to start shipments of iron ore to Europe this summer. Eventually shipments will be at the rate of 2,000,000 tons of iron ore yearly, according to J. E. Hammell, president of the company.

■

Seek U. S.-Alaska Road

On Jan. 16, the Committee on Roads of the House of Representatives, at Washington, held a hearing on a bill introduced by D. A. Sutherland, of Alaska, providing for study of the possibilities of road construction to connect northwestern United States with Alaska. An excellent concrete road now connects Vancouver and Hazelton, B. C. The proposal calls for extension of this road, through one of two routes, to Fairbanks, Alaska. Stimulus of mining activity would probably result from the building of such a road.

Form Northern Rhodesia Power to Supply Copper Mines

Northern Rhodesia Power Corporation, with a capital of £330,000 in £1 shares, has been registered in London. This is a further step toward the electrification of the copper mines in Northern Rhodesia. Companies so far named as being interested in the power concern are British South Africa, Rhodesian Anglo American, Roan Antelope, and Rhodesian Selection Trust, controlling the Mufulira and Chambesi mines. A full investigation into the probable sources of hydro-electric power available for the use of the whole Northern Rhodesian copper district will be made. Already development of about 100,000 hp. from hydro-electric sources is said to be assured.

■

Morenci Mechanical Department Celebrates Safety Record

Mechanical department employees of the Morenci branch of Phelps Dodge, at Morenci, Ariz., were entertained at a banquet recently, given by the company in appreciation of their efforts to prevent lost-time accidents. The department operated during the last six-month period without a single lost-time accident.

Frank Ayer, manager of the local branch, was honor guest, and tables were arranged for 185 employees. Mr. Ayer congratulated the members of the department on their record and stated that there had been no lost-time accidents in the power plant for over four years, none in the machine shop, pipe shop, and boiler shop for three years, and that the electric shop was nearing the end of its third year without a lost-time accident.

■

Muscovite Mica to Ship

Stoping operations have been started at the Muscovite Mica property, near Lewiston, Idaho, and preparations are being made to ship the mica. Since the present company acquired the property about fifteen months ago, a tunnel has been driven to the deposit at a depth of 115 ft. below the old workings, and drifting north has been conducted for 150 ft. Some beryl has also been found on the property, assaying 5 per cent beryllium.

CABLES

EXCLUSIVE TO "ENGINEERING AND MINING JOURNAL" AND "ENGINEERING AND MINING WORLD"
FROM CORRESPONDENTS IN THE PRINCIPAL MINING CENTERS ABROAD

Tanami Report Awakens Interest; Shamva Mines to Suspend Work

London, Jan. 17, 1930.—Interest has been stimulated by the issuing of the first report on the Great Tanami gold mine. E. O. Watt and J. T. Beckett, engineers for the company, state that a gold field that promises to be highly payable has been discovered. A detailed report on the property, situated in northwestern Central Australia, has not yet been received. A rumor is going the rounds to the effect that Waihi Gold has ample funds to take over Tanami and that a large company will be formed. Waihi now has a capitalization of 991,814 shares of 5s. each, on which it has been paying dividends of 40 per cent annually from its mine in New Zealand.

. . . . Renewed American buying of Rhodesian copper shares has started. Prof. J. G. Lawn is highly impressed with prospects of the field. Nevertheless, private advices from Rhodesia state that present prices of the shares are excessive. Also that Rhodesia Broken Hill, the lead-zinc producer, will not be able to resume payment of dividends, suspended in 1922, under present working conditions.

. . . . Shamva Mines, operating on Lone Star Hill, Abercorn district, Southern Rhodesia, is closing down. Dr. Malcolm MacLaren's program of exploration at this property has been carried out and his view proved correct. The mine is now too low grade to warrant further work. Production from this property has been on the basis of about 2,000 tons of ore daily, with an annual production of about £350,000 in gold. Production started in January, 1914, and the company has paid dividends regularly since 1915, although recently profits have been slipping.

. . . . Tin deposits in Tanganyika Territory are attracting some interest. H. G. Latilla, chairman of several of the Nigerian companies, is sending an engineer to examine the deposits. Two companies, Tin Selection Trust and London-Malayan Tin, have agreed to amalgamate with London Tin Syndicate in accordance with the terms offered.

. . . . Malayan output of tin in 1929 is put at 67,040 tons, which compares with 61,935 tons in 1928. New producers are reported to be not restricting production. The companies agree that something should be done, but apparently some of them are waiting for others to make a move. Sunday work has been stopped by 35 dredges and 11 pumping plants. Cornish companies are amalgamating and some are restricting output.

. . . . Russian sales of manganese here have forced down the price. John Cairns has gone to India to investigate the situation in manganese there. Production has been virtually suspended in India, and an accumulated stock of 1,000,000 tons is reported.

. . . . Rio Tinto, the large Spanish copper producer, has abandoned its option to purchase 75,000 shares of Southern Rhodesia Base Metals, which holds the Alaska, Copper King, and Copper Queen mines, in Southern Rhodesia. A small mill is now treating about 150 tons of ore daily at the property.

Oppose Village-Robinson Deal; Turner & Newall Buy New Mine

Johannesburg, Jan. 11, 1930—Certain local opposition by employees and shareholders of Village Deep against absorption by Robinson Deep, the adjoining property on the Central Rand, has become manifest. However, in view of the underground prospects of the two mines, the boards of directors of both companies are satisfied that the proposals are in the best interest of all concerned and the proposed merger will probably go through.

. . . . Details of the proposed merger call for the payment by Robinson Deep of £337,500 for the mining rights of Village Deep, the deepest mine in the world. Village Deep will retain its surface assets, including the township and buildings. This, with the clean-up of the plant, will provide a substantial sum for distribution among the shareholders—probably more than could have been expected during the remaining life of the mine, estimated at not more than six years, even with a continuation of present favorable working results.

. . . . Robinson Deep, itself one of the world's deepest mines, will acquire by the new deal a much-needed additional shaft, permitting rapid and considerable extension of development and mining operations. Without the merger, Robinson might have had to sink a new shaft. An extension of the possible life of both properties is foreshadowed, to say nothing of possibly increased production. At present the combined output of the two mines is about 450,000 oz. of gold annually, exceeded only by Government Gold Mining Areas, Crown Mines, New Modderfontein, and Randfontein.

. . . . The Havelock asbestos mine, in Swaziland, has been acquired by Turner & Newall, the company which is absorbing Rhodesian & General Asbestos. The consideration is £250,000.

. . . . Removal of the headquarters of Rhodesian Anglo American from Broken Hill to N'Kana, in Northern Rhodesia, is expected.

. . . . Official announcement has been made that the gold production of the Transvaal in 1929 was 10,414,066 oz., valued at £44,234,140. Output in 1928 was 10,358,596 oz., valued at £44,000,519. Production from the Witwatersrand created a new record for all time by an increase of 73,525 oz. over 1928's output.

Prepare to Open Up Mimbula; Beatty Resigns From N'Changa

London, Jan. 15, 1930. — Rhodesian copper companies are completing plans for opening up the deposits discovered in that region within the last four or five years to provide for producing at the earliest possible time. Bwana M'Kubwa, because of the excellent drilling results at Mimbula, on the extension of the N'Kana property, has decided to develop both that orebody and the main N'Kana orebody for production. Thus, the 5,000-ton mill will have two mines to draw from when it is completed. Discovered less than a year ago, Mimbula already has been proved as a large, high-grade deposit. At the N'Kana mine, crosscuts have been started on two levels from the two main hoisting shafts. N'Kana has also several incline shafts, from which lateral work is being undertaken.

. . . . Roan Antelope is making excellent progress. Excavation for the site of the main mill building has been completed and foundations are now being poured. The first unit of the power plant is nearly finished. Drilling at the property is now centered on the Roan Extension property, as the persistence of the orebody on the original Roan territory has been pretty thoroughly proved. The number of men employed in the Roan location is put at about 9,000.

. . . . A. Chester Beatty, chairman of the board of directors of Selection Trust and most of its subsidiary companies, has resigned from the board of N'Changa Copper, Burma Corporation, and the British Celanese company. Demands on his time by Trepca Mines and the Rhodesian interests of Selection Trust are given as the only reasons for his resignation.

. . . . E. E. Barker, formerly engineer with Utah Copper, will arrive at the Mufulira mine, in Northern Rhodesia, at the end of this month to become general manager. The company that will take over Mufulira from Selection Trust is now being formed. The railroad to the property, which was finished in September, is delivering material for the 5,000-ton mill that will be built. Construction of the power plant has been started.

. . . . A survey of the native labor situation in Rhodesia shows that it is gradually improving. At present, 20,000 more workers are employed than ten years ago. The Rhodesian mining companies have as many laborers in their employ as Union Minière du Haut-Katanga, in the Belgian Congo. Other enterprises are employing 5,000 more men than in 1920. The available supply is estimated at double that of a decade ago, and workers are easier to obtain. Apparently, the mines will be able to obtain all the colored workers they need. With training, their working efficiency is expected to improve quickly.

MARKET AND FINANCIAL NEWS

Index of Non-ferrous Metal Prices Declines in December

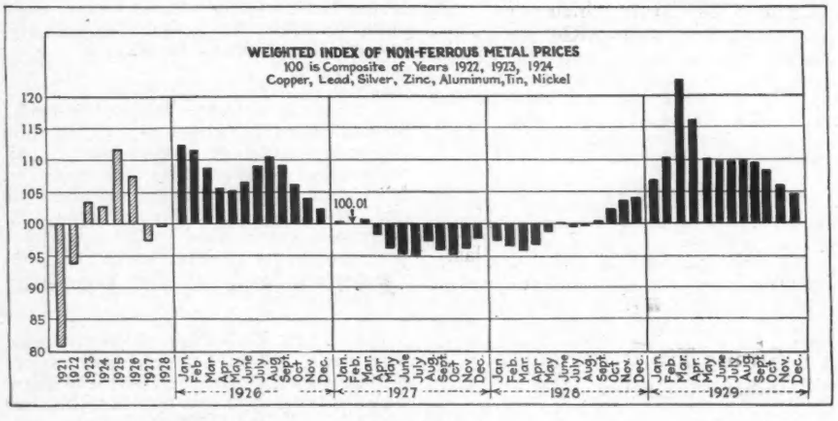
The weighted index number of non-ferrous metal prices for December was 104.75, against 106.09 in the preceding month. The decline resulted from the lower prices which obtained for lead, zinc, tin, and silver. Copper held at 17.775c., refinery, throughout the month, despite the extremely dull condition of the market.

In the average price of lead for December the decline was moderate, and before the month came to a close the position of the market appeared to be quite firm. The price of tin showed little change, with interest centering in the move to bring about a better balance between production and consumption.

The failure of the European Cartel to come to an understanding, together with the constant pressure to sell from weak holders, brought about a general decline in zinc prices. Silver, also, was subjected to selling pressure, prices closing at about the low point for the year.

Aluminum and nickel prices were unchanged throughout the month, as well as for the entire year.

Copper averaged 18.107c., f.o.b. refinery, New York, for the year 1929, which compares with 14.570c. for 1928.



■ ■ ■

U. S. Silver Production Higher in November

Production of silver in the United States during November amounted to 5,614,000 oz., against 5,130,000 oz. in October and 4,756,000 oz. in November, 1928, according to the American Bureau of Metal Statistics. Output in Canada in November was 1,833,000 oz., against 2,605,000 oz. in the preceding month and 1,459,000 oz. in November last year.

World production in September, the latest month for which complete figures are available, was 20,151,000 oz., which compares with 20,612,000 oz. in August and 18,814,000 oz. in September, 1928.

Refined Copper Stocks Up 44,401 Tons in December

Another month of abnormally low shipments of copper to both domestic and foreign consumers resulted in an appreciable increase in stocks of refined metal in the hands of North and South American producers. Stocks of refined copper on Dec. 31 stood at 171,320 tons, a gain of 44,401 tons compared with the figure for the preceding month. Domestic shipments in December dropped to 58,150 tons, and export shipments to 35,652 tons, a total of 93,802 tons.

Combined stocks of blister and refined in North and South America increased during December to the extent of 51,873 tons, bringing the total to 436,894 tons. A year previous the stocks of blister and refined amounted to 315,461 tons.

Mine production in the United States in December was 74,106 tons, against 75,934 tons in November. Production of refined in North and South America in December was 138,203 tons, against 145,376 tons in November.

Refined copper production, shipments and stocks, North and South America, according to the American Bureau of Metal Statistics, follow:

	December 1929	Jan.-Dec. 1929	Jan.-Dec. 1928
Production:			
Primary	126,842	1,696,913	1,551,062
Scrap	11,361	114,944	76,787
Total	138,203	1,811,857	1,627,849
Daily rate	4,453	4,964	4,448
Shipments:			
Exports	35,652	586,594	674,221
Domestic	58,150	1,119,409	983,460
Total	93,802	1,706,003	1,657,681
Stock, Dec. 31	171,320	.....	.....

Production and stocks of blister and refined in the last two months of 1929:

	November, 1929	December, 1929
Production:		
U. S. mines	75,934	74,106
Blister, No. America	107,024	103,025
Blister, So. America	27,007	27,226
Refined, No. and So. Am.	145,376	138,203
World, blister basis	170,585	.....
Stocks:		
No. and So. America:		
Blister and in process	258,192	265,664
Refined	126,919	171,320
Total	385,111	436,984
Great Britain, total	6,928	7,284
Havre	4,814	5,165

Distribution of United States copper production during November and December:

	November, 1929	December, 1929
Porphyry mines	29,812	28,615
Lake mines	8,105	7,292
Vein mines	31,214	31,999
Custom ores	6,803	(a) 6,200
Total crude production	75,934	74,106
Daily rate	2,531	2,391
Imports in ore and matte	7,075	.....
Blister from scrap	4,648	.....
Smelter production	94,861	89,789

(a) Partly estimated.

■

COPPER imports into Germany during the eleven months ended Nov. 30 totaled 185,193 metric tons, against 211,432 tons in the same period in 1928. German production of primary copper in 1929 will show an increase of about 11 per cent, contrasted with the total for the preceding year.

European Notes on Zinc, Selenium and Platinum

DR. JAMES RUBINFELD
Special Berlin Correspondent

THE likelihood of a renewal of the European Zinc Cartel is regarded as slight in German metal circles. Stocks of zinc have been increasing more or less automatically because of the growing need for sulphuric acid for production of superphosphate in Poland, and of synthetic nitrogen in Western Europe. The heavy demand for sulphuric acid has increased ore roastings to a degree not witnessed in some time. The present output of acid, it is pointed out, has attained such large proportions that a surplus has been created in this direction too.

In connection with the zinc situation much attention is directed toward developments in Mexico. The Guggenheim group, according to reports, desires to export a large part of its growing Mexican production to Europe. This, coupled with the construction of a number of electrolytic plants in various parts of the world, has caused general confusion throughout the industry.

An American company plans to participate in the opening of the zinc mines of the French Compagnie des Mines d'Arrens located in the Pyrenees. The Greek-English munition magnate, Sir Basil Zaharoff, and the Lyon artificial silk group of Carnot are also interested in the proposal.

Export of metallic selenium from Russia in the first nine months of 1929 amounted to 1,000 kg. According to reports, no traces of copper are contained in the metal. Production is to be increased.

A German syndicate in Stuttgart has taken over a platinum concession in the Province of Beri Shangul, Abyssinia.

Capacity of zinc plants in France is estimated at 102,000 tons a year by *Minerais et Metaux*. The capacity of the plants in Northern France follows: Auby, 30,000 tons; Mortagne du Nord, 25,000 tons; Noyelles-Dodault, 10,000 tons; Amand-les-Eaux, 3,000 tons—a total for the district of 68,000 tons.

■

TIN CONSUMPTION IN 1930 is expected to reach a good level, though from present indications it seems improbable that the record of 1929 will be repeated, according to bulletin of the Anglo-Oriental Mining Corporation.

Mining Company Dividends and Yields for January, 1930

Companies in the United States	Situation	Per Share	Total Disbursements	Annual Per Cent Yield
Aluminum Company of America, pfd	Various	$1.50 Q	$2,214,930	5.5j
American Zinc, Lead & Smelting, pfd	Tenn.	1.50 Q	120,592	11.3
Bethlehem Steel, pfd	Various	1.75 Q	1,697,500	5.7j
Bunker Hill & Sullivan, l, s	Idaho	0.75 MX	245,250	....
Canam Metals	Various	0.02 I	39,000	....
Consolidated Lead & Zinc	Kan., Okla.	0.125 Q	28,000	9.0
Copper Range, c	Mich.	0.50 Q	197,347	13.3j
Cresson Consolidated, g	Colo.	0.02 Q	24,500	32.0
Eagle-Picher Lead, com., l, s	Okla., Mo.	0.20 Q	200,000	6.1j
Eagle-Picher Lead, pfd., l, s	Okla., Mo.	1.50 Q	12,769	5.9j
Evans Wallower, pfd., l, s	Various	1.75 Q	21,875	8.7
Inspiration Consolidated Copper	Ariz.	1.00 Q	1,181,967	14.8j
Kennecott Copper	Various	1.25 Q	11,715,154	8.6
Magma Copper, c, s	Ariz.	1.25 Q	510,193	10.4j
Metal & Mining Shares, h	Various	0.30 Q	87,395	13.3
Newmont Mining, h	Various	1.00 Q	452,760	3.5
Nichols Copper "A"	Various	0.4375 Q	40,247	....
Phelps Dodge, c	Various	0.75 Q	1,500,000	7.5
Republic Iron & Steel, pfd	Various	1.75 Q	437,500	6.5j
Silver King Coalition, s, l, s	Utah	0.25 Q	305,116	9.7
Sloss-Sheffield Steel & Iron, pfd	Ala.	1.75 Q	40,247	8.7
U. S. Smelting, Refining & Mining	Various	0.875 Q	306,350	10.0j
U. S. Smelting, Refining & Mining, pfd	Various	0.875 Q	425,557	6.7j
Companies in Other Countries				
Consolidated Mining & Smelting, s, l, s	Canada	6.25 SAX.	3,180,394	5.0j
Dome Mines, g	Canada	0.25 Q	238,333	14.2j
Greene Cananea, c, s, g	Mexico	2.00 Q	1,000,000	7.1j
Hollinger Consolidated Gold	Canada	0.05M	246,000	12.0j
Howe Sound, c, l, s	Mexico	1.50 QX	744,057	....
Mexican Premier, s, l	Mexico	0.01 I	....	....
Nipissing, s	Canada	0.075 Q	90,000	17.1j
Noranda Mining, c, g	Canada	0.75 Q	1,639,500	9.0
Premier Gold, s, g	Canada	0.06 Q	300,000	14.7j
Total			$29,242,533	

c, copper; l, lead; z, zinc; s, silver; g, gold; h, holding company; Q, quarterly; QX, quarterly and extra; SAX., semi-annually and extra; ", initial; j, based on dividends for last twelve months; M, monthly; MX, monthly and extra.

Ontario's Gold Output Increaseed in 1929

Total value of crude bullion produced in Ontario in December was $3,041,275, against $2,558,361 in November, and $3,062,736 in December, 1928. Production for the twelve months of 1929 was valued at $33,383,169, which contrasts with a total of $32,688,824 in 1928. Production for the year in the Porcupine district was valued at $19,306,550, against $20,417,714 in 1928. The Kirkland Lake output in 1929 was valued at $14,055,244, against $12,271,110 in the year previous.

The decline for the Porcupine district in 1929 was attributed to destruction by fire of the Dome mill last October.

■

Straits Tin Shipments Show Gain for Year

Shipments of tin from the Straits in 1929 totaled 102,025 tons, which compares with 97,853 tons in 1928, and 81,815 tons in 1927. The shipments during 1929, by countries, were as follows: United Kingdom, 25,429 tons; United States, 58,108 tons; nations of the Continent, 10,880 tons; other countries, 7,608 tons.

Metal Production Down in Colorado in 1929

Mining operations in Colorado in 1929 resulted in the production of 211,381 oz. of gold, 4,323,387 oz. of silver, 8,352,000 lb. of copper, 49,751,000 lb. of lead, and 59,312,000 lb. of zinc, according to the United States Bureau of Mines. In 1928 the production was: 256,623 oz. of gold; 4,052,253 oz. of silver; 8,594,646 lb. of copper; 53,501,723 lb. of lead, and 71,462,000 lb. of zinc. With the exception of silver, all of the metals registered a decline in 1929 compared with the 1928 figures.

Imports of Platinum and Platinum Metals

(According to U. S. Department of Commerce records)

Platinum:	Eleven Months Ended Nov. 30 — 1928 Quantity	1928 Value	1929 Quantity	1929 Value
Ores (platinum content), oz	686	$49,094	564	$43,152
Grains, nuggets, sponge, or scrap, oz	74,256	5,022,538	67,816	4,108,254
Ingots, bars, and sheets, oz	24,718	1,898,632	39,278	2,558,695
Iridium, oz	3,541	595,495	4,124	830,462
Osmium and osmiridium, oz	5,967	421,277	7,443	431,278
Palladium, oz	11,216	362,925	22,464	495,300
Rhodium and Ruthenium, oz	2,712	131,984	3,020	87,121

E.&M.J. Weighted Index of Non-Ferrous Metal Prices

100 Is Composite for 1922-3-4

1920	130.92
1921	80.80
1922	93.94
1923	103.43
1924	102.63
1925	111.74
1926	107.74
1927	97.54
1928	99.78
1929	110.33

	1927	1928	1929
January	100.46	97.54	106.86
February	100.01	96.73	110.37
March	100.84	96.22	122.71
April	98.63	97.14	116.36
May	96.41	99.05	110.03
June	95.55	100.16	109.66
July	95.42	99.69	109.58
August	97.25	99.85	109.81
September	96.01	100.53	109.29
October	95.36	102.34	108.52
November	96.22	103.83	106.09
December	98.30	104.28	104.75

Low Prices Expected to Influence World Production of Zinc

INTERNATIONAL METAL SERVICE, LTD.,
LONDON

THE year 1929 ended with the expiry of the zinc cartel, and little hope exists of a new organization. The position of the industry is definitely worse in that we are now faced with unfettered competition between producers for such business as is going—a prospect which is the reverse of pleasing for all connected with the production of zinc. Many of the mines are finding it unattractive to go on working at current levels and have reduced output, or in some cases suspended deliveries—taking advantage of the "stop" clause in their contracts; but whether any really important tonnage is thus affected cannot be ascertained now.

At £19 12s. 6d. for December shipment, the year ended with zinc at a lower level than for twenty years or so, and a figure which represents a startling drop compared with the £26 17s. 6d. of the last day of 1928 and £29, the high for 1929.

World production of slab zinc for 1929 appears close to 1,450,000 metric tons, or about 25,000 tons more than in 1928, so that, after allowing for increases in stocks on producers' hands and for consumers having a much smaller reserve than at the beginning of the year, there has been apparently no real gain in world consumption, a factor which would go a long way toward accounting for the disappointments of the last year.

The future cannot be viewed with much optimism. To come down to bedrock it seems that the European distillation smelters are actually fighting for their existence, and we fear that in most instances the fight is a losing one, as the steady growth in world production of electrolytic metal must adversely affect the demand for distillation zinc. In other words, the fresh production of High-grade zinc will be greater than any conceivable increase in world consumption. Consequently, every additional ton of High-grade metal turned out over such limit can be absorbed only at the expense of a similar tonnage of G.O.B. zinc.

Aside from the decision of American interests to treat their Mexican ores in Mexico, which indeed seems to have been the deathblow to the cartel, Australia is increasing her output from the Risdon works by 30 per cent, and there are the Canadian projects—one of which will be operating at the end of the current year—which must mean a substantial increase in her output of metal in the succeeding years. Thus, even if the efforts to find some means of carrying on the cartel are not definitely abandoned, we cannot see that anything but a purely temporary palliative can be forthcoming. Were the requisite cheap power available to Britain, Belgium, Germany, and Poland, there would be a general conversion of distillation smelters into electrolytic works. As it is, the distillation smelter today cannot look for relief to any reduction in working costs or an increase in recovery.

Supplies of raw materials are now mainly byproducts from the lead mills, and here, with new sources of supply under development throughout America and elsewhere, the outlook for those mines which are essentially producers of zinc ores is by no means a happy one.

Taking everything into consideration, we are of the opinion that those connected with the European zinc industry must reconcile themselves to the fact that in the future the selling price for zinc should normally be below that for lead; but this, of course, does not mean that we regard the current quotation of under £20 as a true valuation of G.O.B. This price is abnormally low, and whether the cartel can be re-formed or not, natural causes should soon begin to operate and force some curtailment of output, and so lead to a modest recovery in value.

World stocks of zinc Dec. 31, 1929, by countries, follow:

	Metric Tons
United States	70,100
Canada, including afloat	3,700
Germany-Poland	17,100
Belgium	10,900
France	2,400
Great Britain	4,600
Other Europe	3,300
Australia, including afloat	4,000
Far East	1,300
Elsewhere	2,000
Total	119,400

■

Production of Metals and Minerals in Mexico

Production of metals and minerals in Mexico for the first eight months of 1929, compared with the same period in 1928, in kilograms, according to the Mexican Department of Mines, follows:

	1929	1928
Gold	12,065	14,766
Silver	2,042,270	2,229,805
Lead	154,454,746	154,649,267
Copper	52,045,032	39,165,058
Zinc	94,904,097	103,929,696
Quicksilver	51,445	54,181
Antimony	1,708,231	2,140,445
Arsenic	6,161,740	5,699,586
Cadmium	243,362	191,524
Tin	4,853	1,881
Selenium	148	.....
Tungsten	1,476	.....
Vanadium	806	.....
Grapnite	4,252,906	4,016,781

Refined Lead Stocks Reduced in U. S. and Mexico

Stocks of refined lead, including antimonial, in the United States and Mexico on Dec. 31 totaled 61,675 tons, against 68,004 tons in November and 71,548 tons in October. Production of crude in the two countries in December was 76,920 tons, against 80,803 tons in the preceding month. Production of refined, including antimonial, was 78,418 tons, against 85,893 tons in November.

Stocks of lead in all forms in the United States and Mexico on Dec. 1 totaled 161,671 tons, a decline compared with the figure for the preceding month of 5,521 tons. The holdings, the smallest since last May, were classified by the American Bureau of Metal Statistics as follows: In ore and matte and in process at smelters, 48,836 tons; in base bullion, at smelteries and refineries, 14,263 tons; in transit to refineries, 9,642 tons, and in process at refineries, 20,926 tons; refined lead, 57,470 tons; antimonial lead, 10,534 tons.

■

U. S. Iron Ore Output Increased in 1929

Iron ore mined in the United States in 1929, exclusive of ore containing 5 per cent or more of manganese in the natural state, totaled 73,283,000 gross tons, an increase of 18 per cent compared with 1928, according to the U. S. Department of Commerce.

The ore shipped from the mines was estimated at 75,589,000 gross tons, valued at $197,007,000, an increase of 19 per cent in quantity and 26 per cent in value. The average value of the ore per ton at the mines in 1929 was estimated at $2.61, against $2.46 in the preceding year. Stocks of ore at the mines, mainly in Michigan and Minnesota, decreased from 9,190,061 tons in 1928 to 7,102,000 tons in 1929.

■

Further Curtailment by United Verde Copper

The United Verde Copper Company has recently made another reduction in its smelter output at Clarkdale, Ariz., with a corresponding adjustment at the mine in Jerome. This is the third successive move in curtailment since April, 1929.

Prior to June, 1929, the company had three reverberatory and two blast furnaces in operation, with a production of about 6,500 tons of copper a month. The average monthly production for 1929 was about 6,000 tons. The present schedule is on the basis of operating two reverberatory furnaces only, bringing the monthly rate of production down to less than 3,500 tons.

London Tin Operators Wary About Hidden Stocks

W. A. Doman
Special London Correspondent

Strenuous efforts are being made to put the tin-mining industry on a satisfactory basis. The movement of prices in recent weeks has not reflected a change for the better in the general situation. The deduction from this state of affairs naturally is either that the trades in which the metal is largely used are slackening, or that large stocks are hidden in various centers, and the latter suggestion seems to be credited more than the former by tin traders in this country. Fluctuation of share values in recent months seems to indicate that the schemes put forward for stabilizing and rationalizing the industry have not received the full support of shareholders.

Another merger in the tin industry is in progress, that of the Anglo-Nigerian Corporation. This company has a nominal capital of £600,000, and will embrace Nigerian Base Metals, Ltd., Nigerian Power & Tin Fields, Ltd., and the Anglo-Nigerian Tin Mines. Naturally, if companies in Malaya amalgamate, and companies in Nigeria follow suit, the obstacles in the way of further fusions of the enlarged undertakings will not be so difficult. Hopes are entertained that in the not distant future it will be possible to raise the price of the metal.

■

Texas and South Dakota Mine Output in 1929

Metal mines in Texas in 1929 produced, in terms of recovered metals, $28,000 in gold, 1,050,000 oz. of silver, 1,000,000 lb. of lead, and 400,000 lb. of copper, according to the United States Bureau of Mines. This compares with a 1928 production of $10,115 in gold, 1,340,622 oz. of silver, 695,570 lb. of lead, and 447,792 lb. of copper, indicating an increase for 1929 in the output of gold and lead, and a decrease in the output of silver and copper.

The mines in South Dakota in 1929 produced $6,523,000 in gold and 85,000 oz. of silver, comparing with $6,560,805 in gold and 90,547 oz. of silver in 1928. Production of the Homestake mine, the largest producing gold mine in the United States, was slightly less than in 1928, preliminary estimates indicate. The only other producer in South Dakota in 1929 was the Keystone Consolidated Mines, Inc., which shipped bullion to the Denver mint.

■

Chile, Braden, and Andes Copper Production

Production of copper by South American producers showed little change in October, contrasted with the figures for the preceding month. Production by Chile Copper in October amounted to 11,042 short tons, against 11,021 tons in September. Braden produced 7,646 tons in October, which compares with 7,656 tons in the month previous. Andes Copper's output for October was 6,538 tons in October, the figure being virtually the same as in the September period.

■

Arsenic Output Shows Decline in November

Crude arsenic output in the United States in November amounted to 1,203 tons, against 3,113 tons in October. Deliveries of crude to refiners totaled 1,309 tons, and to consumers 91 tons. Stock of crude at the end of November was 3,112 tons, compared with 3,309 tons in the previous month.

Production of refined arsenic in November was 1,197 tons, against 1,036 tons in October. Stock of refined on Nov. 30 was estimated by the American Bureau of Metal Statistics at 3,993 tons, comparing with 3,672 tons at the end of October.

Gold Output in U. S. Down in 1929—Silver Up

Production of gold in the United States in 1929, according to a preliminary estimate by the Bureau of the Mint, totaled 2,128,027 oz., valued at $43,990,200. The estimate indicates a reduction in value of $2,175,200, compared with 1928.

Silver production in 1929 is estimated at 60,937,600 oz., valued at $32,540,000. Contrasted with the figures for 1928 the output of silver increased in volume by 2,475,093 oz.

In the year of largest production, 1915, the output of gold was valued at $101,035,700.

■

Consolidated Mining of Canada

Consolidated Mining & Smelting Company of Canada, in 1929 produced 150,217 tons of lead, 86,049 tons of zinc, 4,173 tons of copper, 14,694 oz. of gold, and 7,362,164 oz. of silver. This compares with production in 1928 of 159,416 tons of lead, 81,765 tons of zinc, 8,903 tons of copper, 13,623 oz. of gold, and 7,673,762 oz. of silver.

■

Alaska Copper Shipments

Shipments of copper ore and matte from Alaska during December amounted to 9,031 tons, valued at $819,523. The copper content of the ore was estimated by the Department of Commerce at 4,551,302 lb.

■

U. S. Lead Production

Production of refined lead from domestic ores in 1929 totaled about 689,000 tons, according to the United States Bureau of Mines. In 1928 the production of lead was 626,202 tons. Output of lead smelted and refined from foreign ore and bullion during 1929 was estimated at 103,000 tons.

Current Statistics of Production and Stocks of Copper, Lead, and Zinc

Data from American Bureau of Metal Statistics, and American Zinc Institute

Figures Represent Short Tons

	1928	1929											
COPPER—North and South America	Average	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov	Dec.
Production, refined, daily average	4,448	4,983	5,049	5,276	5,378	5,219	4,630	4,952	4,795	4,478	4,930	4,846	4,458
Domestic shipments	81,955	100,135	98,771	105,860	99,051	93,743	95,258	98,720	96,970	98,043	105,729	68,979	58,150
Foreign shipments	57,185	57,054	50,150	59,946	57,708	55,123	48,461	40,204	45,035	45,921	53,461	37,879	35,652
Stocks, blister and refined	300,771	307,959	296,298	295,309	311,003	332,641	334,621	337,199	346,050	348,270	343,187	385,111	436,984
LEAD—United States and Mexico													
Production, smelter, daily average	2,514	2,656	2,559	2,617	2,720	2,792	2,777	2,723	2,556	2,631	2,773	2,693	2,481
Production, U. S. mines, daily average	1,785	1,891	1,723	2,118	2,083	2,067	1,925	1,881	1,904	1,893	1,993	1,983	.....
Imports into U. S. A.	12,757	22,924	9,551	8,383	7,115	6,944	9,412	12,572	12,493	8,515	6,251	4,452	.....
Stocks, smelter and refinery	160,511	156,182	160,597	158,149	156,888	162,255	173,612	173,549	175,641	168,707	167,192	161,671	.....
ZINC—United States													
Production, daily average	1,693	1,604	1,720	1,790	1,822	1,837	1,708	1,756	1,783	1,776	(b) 1,643	(b) 1,587	(b) 1,567
Domestic deliveries	48,301	47,677	51,057	56,267	56,558	56,614	47,973	46,570	50,610	46,287	47,184	41,636	34,389
Exports, slab zinc	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Exports, ores and dross	453	545	165	483	308	358	266	537	173	211	247	122	.....
Stocks	44,333	45,418	40,620	37,962	34,588	33,826	36,932	44,122	47,833	53,363	57,116	63,061	77,262
World Production Rate (Daily Average)													
Copper	5,236	5,767	5,968	6,219	6,561	6,213	5,820	5,624	5,629	5,595	5,809	5,686	5,334
Lead	4,976	5,037	5,068	5,176	5,418	5,440	5,467	5,277	5,200	5,301	5,494	5,446	.....
Zinc	4,271	4,231	4,357	4,448	4,537	4,528	4,483	4,388	4,397	4,437	4,385	4,365	.....

(a) Withheld pending investigation of government reports. (b) Zinc produced in U. S. from Mexican ore not included.

Active Demand for Lead—Moderate Call for Copper—Silver Up from Low

New York, Jan. 15, 1930—Decline in silver prices was arrested by demand from the Far East which caused an upward reaction in the quotations from 43⅞c. a week ago to 46¼c. today. This also steadied the antimony market somewhat. Among the base metals, the continued strength of the lead market, while other metals are in only moderate demand, is easily a feature. Producers are sold out of current production, but hesitate to advance prices with industrial conditions as they are unless they are assured that the present excellent demand for lead will continue. Demand for prompt copper continues to be much better than a month ago, but is not yet up to a normal week, even after a four months' lull in buying. Further curtailment in production is announced. Zinc continues to weaken, with consumers beginning to inquire for far forward shipment. Tin is slightly lower, with moderate demand.

Little Change in Copper

The increase in refined stocks of copper was generally discounted, so had no bearish effect on the market. Another sizable increase must be expected this month, though further curtailment is being made at the mines. Anaconda this week will shut down three of its Butte mines, United Verde is curtailing further, and other companies are doubtless following suit. A moderate tonnage of copper was sold in the last two weeks, almost entirely for prompt shipment. The brass companies have obtained a few orders from the automotive industry, and the public utilities are placing a little wire business. Though some improvement is seen by fabricators, their business continues less than they expected it would be at this time, and they are in no mood to buy copper except as actually needed. Producers remain a unit in their desire to maintain the 18c. delivered price indefinitely. The foreign market is quiet, but total export sales promise to be better in January than in any of the three previous months.

Lead Continues Active

Activity in lead again was of a high order, the sales volume since Jan. 1 being well above the average. The prices were firm in all directions, though unchanged at 6.25c., New York, the contract basis of the American Smelting & Refining Company, and 6.10c., St. Louis. A feature in the market was the persistent buying of lead for prompt and January shipment, almost half of the sales total for the period being involved in the transactions covering the near positions. Consumers are coming into the market for February metal on a good scale. As for March forward, little has been done, for the simple reason that sellers were not anxious to quote ahead. The buying was well distributed among the leading consuming industries. Corroders were particularly active so far as near-by lead was concerned. Cable makers were good buyers, with the battery manufacturers taking larger quantities than a short time ago.

Zinc Drops to 5.15c.

Many zinc producers continue unwilling sellers at present levels, but enough anxious sellers are in the market to continue to force prices down. For the thirteenth successive week the average price of zinc has declined, dropping from 6.80c., which was last quoted on Oct. 19, to the present level of 5.15c., at which several hundred tons of zinc have been sold yesterday and today for various deliveries from prompt to April. Some consumers are endeavoring to book business for the entire first half of the year at current quotations, but have so far apparently been unsuccessful. If the price of concentrate in the Tri-State district continues at $35, at which level it seems fairly stable, it seems probable that smelters will close down furnaces rather than lower prices much further, as their profit is at the vanishing point.

Tin Prices Unsettled

Tin prices failed to respond to the encouraging statements regarding restriction of production. In fact, the average price for the week was slightly lower than last week. Buying was moderate, though when the price fell below 39c. the demand underwent some improvement. Consumers here feel that prices will show no wide variation in the near future, and this, in a measure, accounts for the conservative buying. Advices from London reported that more than 100 tin-producing plants in Malaya closed down over the week-end, in line with the restriction of output program announced some time ago.

Silver Advances

During the last week fluctuations in the price of silver have been more pronounced, caused by a more active interest shown in the market as a result of heavy buying from India and both buying and selling for China account. The tendency is uncertain.

Mexican Dollars (old Mexican pesos): Jan. 2d, 35⅛c.; 3d, 34⅝c.; 4th, 33½c.; 6th and 7th, 33c.; 8th, 32½c.; 9th, 33c.; 10th, 32⅞c.; 11th, 33½c.; 13th, 34½c.; 14th, 33¾c.; 15th, 34½c.

Foreign Exchange

Closing cable quotations on the leading Continental exchanges on Tuesday, Jan. 14, were: Francs, 3.92½c.; lire, 5.23⅛c.; and marks, 23.885c. Canadian dollars, 1⅜ per cent discount.

Flotation Concentrate Moves Up $1 in Tri-State

Joplin, Mo., Jan. 11, 1930

Blende	Per Ton
High	$38.00
Premium blende, basis 60%..	35.00
Prime Western, basis 60%...$34.00@	35.00
Table concentrate, 60%..... 33.00@	34.00
Flotation concentrate, 60%..	33.00
Average settling price.....	34.10
Galena	
High	$77.30
Basis 80% lead.....	75.00
Average settling price.....	76.16

The long-maintained $3 differential between the quotation for Prime Western zinc concentrate and flotation concentrate was changed recently by advancing the latter $1 per ton. Lead prices were unchanged.

To Users of "E. & M. J." Market Prices and Data

UNDER the publishing plan announced previously, the new semi-monthly *Engineering and Mining Journal* (which you are now reading) carries only a condensed review of important market news and price movements. For buyers and sellers of ores, metals, and minerals who require the latest information every week, we now publish every Wednesday night a new weekly—*E.&M.J. Metal and Mineral Markets.* Printed at high speed, mailed 48 hours earlier than heretofore, and in a new compact form for reference use, this new service has received enthusiastic indorsement from readers not requiring the technical contents and field operating news carried in the magazine. *Metal and Mineral Markets* is priced to subscribers in the United States and possessions at $2 yearly; to countries in the Americas, but outside the United States, $5; elsewhere, $10 per annum—52 issues.

Daily Prices of Metals

Jan.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
2	17.775	39.625	6.25	6.10	5.45
3	17.775	38.75	6.25	6.10	5.375@5.40
4	17.775	38.75	6.25	6.10	5.25@5.40
6	17.775	38.75	6.25	6.10	5.30@5.40
7	17.775	39.625	6.25	6.10	5.30@5.35
8	17.775	39.125	6.25	6.10	5.25@5.30
Av'ge	17.775	39.104	6.250	6.100	5.352
9	17.775	39.25	6.25	6.10	5.25
10	17.775	39.25	6.25	6.10	5.25
11	17.775	39.00	6.25	6.10	5.20@5.25
13	17.775	38.75	6.25	6.10	5.20
14	17.775	38.75	6.25	6.10	5.15
15	17.775	38.875	6.25	6.10	5.15
Av'ge	17.775	38.979	6.250	6.100	5.204

Average prices for calendar week ended January 4, 1930, are: Copper, 17.775c.; Straits tin, 39.225c.; New York lead, 6.250c.; St. Louis lead, 6.100c.; zinc, 5.413c.; and silver, 46.375c.

Average prices for calendar week ended January 11, 1930, are: Copper, 17.775c.; Straits tin, 39.167c.; New York lead, 6.250c.; St. Louis lead, 6.100c.; zinc, 5.279c.; and silver, 44.667c.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices of refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary forms of wirebars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight differential. Contract prices for High-Grade zinc delivered in the East are 1@1.15c., depending upon purity, above St. Louis prices for Prime Western.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Jan.	Copper		Electrolytic	Tin		Lead		Zinc	
	Standard								
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
2	71 3/8	70	83	180 1/4	183 5/8	21 7/16	21 1/2	19 3/4	20 3/8
3	69 3/4	68 3/8	83	175 1/2	178 3/4	21 7/16	21 1/2	19 5/8	20 5/16
6	70 1/8	68 7/8	83	175	178 1/4	21 3/8	21 1/2	19 7/16	20 1/16
7	71 1/2	69 7/8	83 1/4	176 1/8	179 1/4	21 7/16	21 9/16	19 3/4	20 3/8
8	71 5/8	69 1/2	83 1/4	178 3/8	181 3/8	21 9/16	21 5/8	19 3/4	20 3/8
9	71 3/8	69 3/4	83 1/4	176 1/4	179 3/4	21 9/16	21 5/8	19 1/2	20 3/16
10	71 1/2	69 3/4	83 1/4	176 3/4	180	21 7/16	21 9/16	19 7/16	20 1/8
13	71 3/4	69 1/4	83 1/4	174 7/8	178 1/2	21 5/8	21 5/8	19 3/4	20
14	71 7/8	69 1/2	83 1/4	174 3/8	177 5/8	21 5/8	21 5/8	19 1/4	19 7/8
15	72	69 1/4	83 1/4	174 7/8	178 3/8	21 9/16	21 9/16	19 1/4	19 7/8

Prices for lead and zinc are the official prices for the morning session of the London Metal Exchange; prices for copper and tin are the official closing buyers' prices. All are in pounds sterling per long ton (2,240 lb.).

Silver, Gold, and Sterling Exchange

Jan.	Sterling Exchange "Checks"	Silver		Gold London	Jan.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
2	$4.87 9/16	46 7/8	21 5/8	84s 11 1/4d	9	$4.86 13/16	44 3/4	20 13/16	84s 11 1/2d
3	4.87 1/8	46 3/8	21 5/16	84s 11 1/2d	10	4.86 1/2	44 1/2	20 13/16	84s 11 1/2d
4	4.87 1/8	45 3/8	20 15/16	.....	11	4.86 3/8	45 3/8	21 1/8	.....
6	4.86 7/8	44 3/4	20 5/8	84s 11 1/2d	13	4.86 3/8	46 1/2	21 7/16	84s 11 1/2d
	4.86 7/8	44 3/4	20 11/16	84s 11d	14	4.86 5/16	45 5/8	21 1/8	84s 11 1/2d
8	4.86 1/2	43 7/8	20 7/16	84s 11 1/2d	15	4.86 7/16	46 1/4	21 3/8	84s 11 3/8d

Average for week ended Jan. 8: Silver, 45.333c.; Sterling Exchange, $4.870
Average for week ended Jan. 15: Silver, 45.458c.; Sterling Exchange, $4.865

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of silver, 999 fine. London silver quotations are in pence per troy ounce of bar silver, basis of 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c. London, 98 per cent, quoted at £95 per long ton, less 2 per cent for domestic consumption.

ANTIMONY—Per lb., duty paid: Chinese brands, spot, 8½@8⅝c.; futures, 8c. Fair call for spot; futures irregular on unsettlement in silver, though the market steadied somewhat toward the close. Cookson's "C" grade, spot, 14c. Chinese needle, lump, 8c. Standard powdered needle, 200 mesh, 10c.

BISMUTH—Per lb., in ton lots, $1.70. Smaller lots $1.85 and up. London 7s. 6d.

CADMIUM—Per lb., 80@90c. London, 3s.11d.@4s. for prompt.

CHROMIUM—Per lb., 97@98 per cent grade, 95c.@$1.

COBALT—Per lb., f.o.b. Canadian works: Shot or rondelles, 97@98 per cent, $2.50. Contract sales booked at discounts, depending on quantity. Black oxide, 70 per cent, $2.10. London, nominal, 10s. for metal in small lots, 8s. for black oxide; 8s. 10d. for gray.

GERMANIUM DIOXIDE—Per gram in 200- to 300-gram lots, $3.50.

IRIDIUM—Per oz., $210@$220 for 98 @99 per cent sponge and powder. London, £39@£42.

LITHIUM—Per oz., 98@99 per cent grade in 2- to 6-lb. lots, $6.

MAGNESIUM—Per lb., single orders for spot metal: 8-lb. ingots (3x3x15 or 16 in.), 95c.@$1.05, depending on quantity; 2½- or 3-lb. sticks (1⅜ in.) 90c.@$1.10, depending on quantity; 10-oz. sticks (1x12 in.), 80c.@90c. Discounts up to 20 per cent on larger orders or contracts. London 3s. 3d.@ 3s. 6d. for 99 per cent ingots or sticks.

MOLYBDENUM—Per lb. in 50- to 100-lb. lots, 99 per cent, $11. (Usually sold as calcium molybdate or ferromolybdenum.)

NICKEL—Per lb., ingot, 35c.; shot, 36c.; electrolytic, 35c. (99.90 per cent), for single lots of spot metal. London, per long ton, £170@£175. Expansion in the use of nickel-chromium corrosion-resisting steels is a factor in the market, these steels containing about 8 per cent nickel. Contracts for 1930 nickel requirements, at unchanged prices of 30@ 32c. per lb., depending on quantities, are exceedingly reassuring to producers.

OSMIUM—Per oz., $70, nominal. London, £13 15s.

PALLADIUM—Per oz., $35@$36; London. £6 10s.@£7.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $63. Transactions between dealers and refiners in the outside market are com-

monly reported at several dollars less.

London, per oz., £12 10s.@£13 for refined; crude and scrap, nominal at £11@£11 15s.

QUICKSILVER—Per 76-lb. flask, $121 @$122. Market continues quiet and prices on round lots are nominal. London quiet, with offers of spot at £23.

RADIUM—Per mg. radium content, $70.

RHODIUM—Per oz., $50@$55. Nominal. London, £11@£12.

RUTHENIUM — Per oz., $42@$48. Nominal. London, £9.

SELENIUM—Per lb. in 500-lb. lots: Black, powdered, amorphous, 99.5 per cent pure, $2. London, 7s. 8d.@ 7s. 9d.

TANTALUM — Per gram: Bar and heavy sheet, chemically pure, 16c.; tantalum powder, 11c.

TELLURIUM—Per oz., 15@18c.

THALLIUM METAL—$12.50@$15 per pound.

TITANIUM—Per lb., 80@90 per cent grade, $5.

TUNGSTEN POWDER—Containing 98 per cent tungsten, per lb., $1.70@$1.75.

VANADIUM—Per gram, 92@95 per cent grade, $1.20@$1.25.

Metallic Ores

ANTIMONY ORE—Bolivian ore, 60 per cent metallic antimony, $1.30 per short ton unit, c.i.f. New York.

CHROME ORE—Per long ton, f.o.b. Eastern shipping points, Indian and Rhodesian ores, $21.50 for 46@47 per cent Cr_2O_3 ore, and $24 for 50@51 per cent ore. New Caledonian ore, high-grade, $25.

IRON ORE—Per long ton, lower Lake ports. Lake Superior ores:

Mesabi, non-bessemer, 51½ per cent iron, $4.50. Old Range, non-bessemer, $4.65.

Mesabi, bessemer, 51½ per cent iron, $4.65. Old Range, bessemer, 51½ per cent, $4.80.

Eastern ores, cents per unit, delivered at furnaces: Foundry and basic, 56 to 63 per cent, 9c.

Foreign ores, f.o.b. cars Atlantic ports, cents per unit:

North African, low-phosphorus, 12½c.

Spanish and North African basic, 55@60 per cent, 11½@12c.

Swedish foundry or basic, 66@68 per cent, 10½c.

Newfoundland foundry, 55 per cent, 8½@9c. Nominal.

MANGANESE ORE—Per long-ton unit of Mn, c.i.f. North Atlantic ports. Exclusive of duty: Brazilian and Indian ores, minimum 47 per cent Mn, 31@34c. Caucasian, 53@55 per cent, 36c. Cuban, minimum 47 per cent, 35c. Chilean, minimum 47 per cent, 34c.

Per ton in carload lots:

Chemical grades, powdered, coarse or fine, 82@87 per cent MnO_2, Brazilian, Javan, Caucasian, and Cuban, $60@$65. Domestic, 70 to 72 per cent, $40@$50.

TANTALUM ORE—Per unit of Ta_2O_5, basis 60 per cent ore, $13.

TITANIUM ORE—Ilmenite, per gross ton, 50 per cent TiO_2, f.o.b. Atlantic seaboard, $9.50@$11, according to grade and impurities. Low-grade domestic, 32 to 35 per cent, about $7@$8 per gross ton. Rutile, per lb., guaranteed minimum 94 per cent concentrate, 10c. in carload lots.

TUNGSTEN ORE—Per short ton unit of WO_3, N. Y.: Wolframite, $15.50 for future delivery. Prices on near-by material are firm on limited offerings. Bolivian scheelite is quoted at $15.50, Jan.-Feb. shipment. Western scheelite, $16.50, with business passing on this basis for delivery over the first half of the year.

VANADIUM ORE—Per lb. V_2O_5 contained, 28c.

ZIRCON ORE—Per net ton containing 55 per cent ZrO_2, f.o.b. Atlantic seaboard, $40@$45 in 30-ton lots.

Metallic Compounds

ANTIMONY OXIDE — White, Chinese. 99 per cent Sb_2O_3, 10½@11c. per lb. Nominal.

ARSENIOUS OXIDE (White arsenic)—Per lb., 4c., delivered, all positions. London, per long ton, £16 for Cornish white.

CALCIUM MOLYBDATE OR MOLYTE—Per lb. of contained Mo, 95c.

COPPER SULPHATE (Blue Vitriol)—Per lb. in car lots, 5½@6c. for either large or small crystals.

SODIUM NITRATE—Per 100 lb.; crude natural, in bags ex vessel, Atlantic ports, $2.14 for February deliveries.

SODIUM SULPHATE (Salt Cake)—Per ton, bags, f.o.b. works, $22@$23; in barrels, $25@$28.

Refractories

CHROME BRICK—Per net ton, f.o.b. shipping point, $45.

FIRECLAY BRICK — Per M.: First quality, $43@$46; second, $35@$38.

MAGNESITE—Brick, per net ton, f.o.b. works: 9-in. straights, $65, f.o.b. plant. Cement, $40, seaboard.

SILICA BRICK—Per M., $43@$52, f.o.b. shipping point.

ZIRKITE—Per lb.: Powdered, 65@70 per cent ZrO_2, 3½c. Brick, straights, 80c.@$1 each.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity.

ASBESTOS—Per ton; f.o.b. Quebec mines, tax and bags included, prices quoted by leading interest for delivery on contract:

Crude No. 1, $550@$750; crude No. 2, $450@$575; spinning fibers, $225@ $275; magnesia and compressed sheet fibers; $175@$225; shingle stock, $55@ $115, various grades; paper stock, $45@50; cement stock, $25; short fibers, $10@$20; floats, $12@$15.

Per ton c.i.f. New York: Rhodesian crude No. 1, $450; No. 2, $350.

BARYTES—Per ton: f.o.b. mines, bags extra:

Georgia: Barytes ore, crude (per long ton), $9. Washed and water floated to 97 per cent through 325 mesh, $18.

Missouri: Water ground and floated, bleached, $23, car lots, f.o.b. works. Crude ore, 93 per cent $BaSO_4$, not to exceed 1 per cent iron, $7.75@$8 f.o.b. mines.

BAUXITE—Per long ton: Domestic ore, chemical, crushed and dried, 55 to 58 per cent Al_2O_3, 1.5 to 2.5 per cent Fe_2O_3, $7.50@$8.25 f.o.b. *Alabama* and *Arkansas* mines. Other grades, 56 to 59 per cent Al_2O_3, 5 to 8 per cent SiO_2, $6.75@$8.25 f.o.b. *Arkansas* mines.

FELDSPAR—F.o.b. mine or grinding plant:

North Carolina, per long ton, No. 1 pottery grade, crude, $6.50@$8; No. 2, glass grades, $5.50@$6.

No. 1, pottery, 140 mesh, $16; 200 mesh, $18. No. 2, enamel, 20 mesh, $10.25@$12; 140 mesh, $13.50@$16; 200 mesh, $15@$18; all per short ton.

New Hampshire, per ton: Pottery grade, $8. Best quality lump, $8.75.

New York, per ton: f.o.b. cars, No. 1 crude, $9. Soda-potash feldspar, 140 mesh, first grade, $16 per short ton; 200 mesh, first grade, $18.

Maine, per ton: Best pottery grade, ground, $19.

FLUORSPAR — Per ton: F.o.b. *Kentucky* and *Illinois* mines:

Gravel, not less than 85 per cent, $18. Foundry lump, 85-5, $20. Ground, 95 to 98 per cent CaF_2, and not over 2½ per cent SiO_2, $32.50 in bulk; $36.50 in bags or barrels. Acid lump, 98-1, $30 in car lots.

New Mexico: 85-5 gravel, $16.50; 85-5 lump, $16; 94 lump, $21; ground, 97, $35.

GRAPHITE—Per lb., f.o.b. *New York:* Ceylon lump, 7@8¾c.; chip, 6@7c.; dust, 3@5c.; Madagascar flake, 6½@8c.

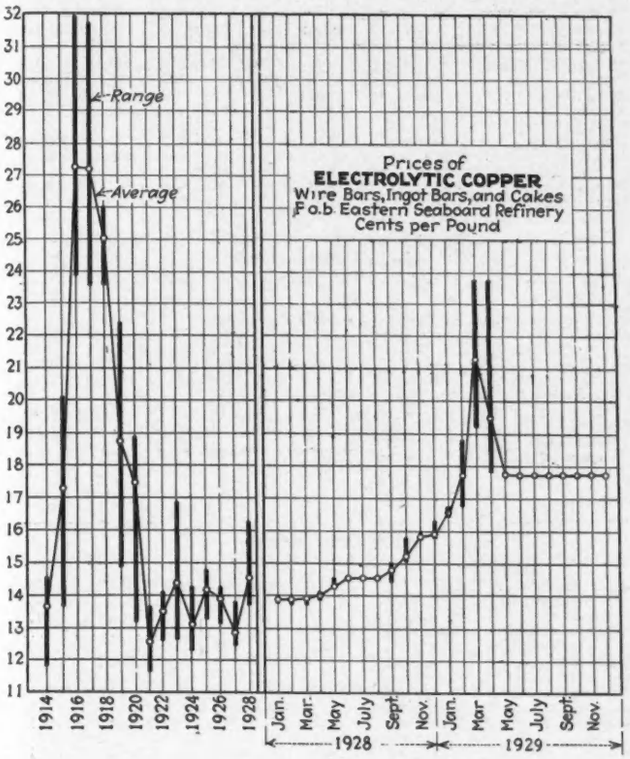
No. 1 flake, 8@16c.; fine ground, 5@15c. Ordinary fine ground, 4@6c.; high grade, 8@12c.; amorphous, 3@7c.

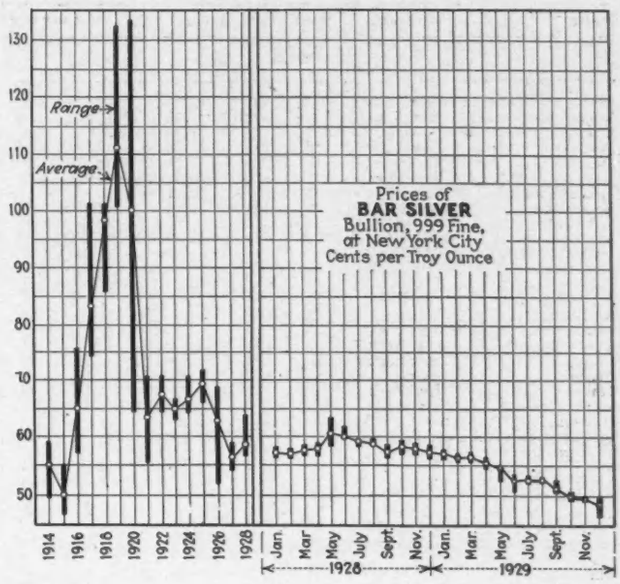
Crude amorphous graphite, $15@$35 per ton, according to grade.

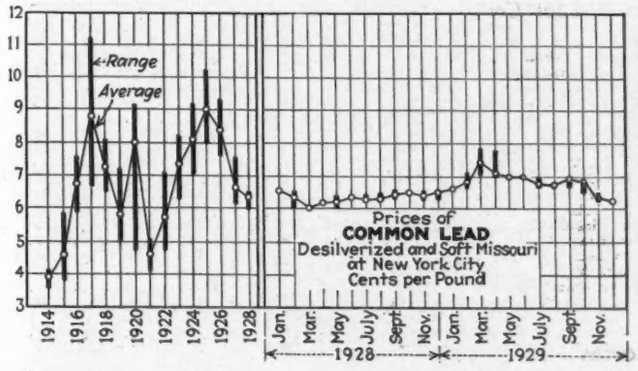
MAGNESITE — Per short ton, f.o.b. *California* mines: Calcined, 80 per cent through 200 mesh, $43. dead burned, $29; crude $11. *Washington:* Dead-burned magnesite, $22@$24 per net ton, Chewelah, Wash.

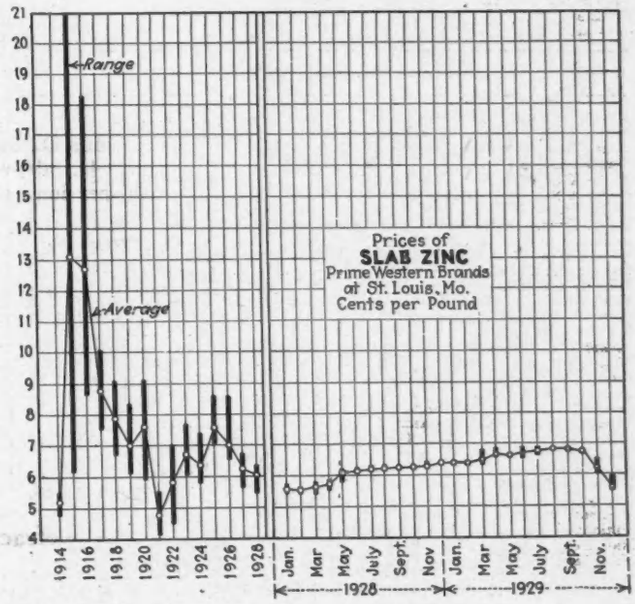
PYRITES—Per long ton unit of sulphur: C.i.f. United States ports; guaranteed 48 per cent sulphur: Spanish 13c.; Tharsis, furnace size, 2½ in. diameter 14c. Cinder from ore to remain property of buyers.

Metal Price Curves

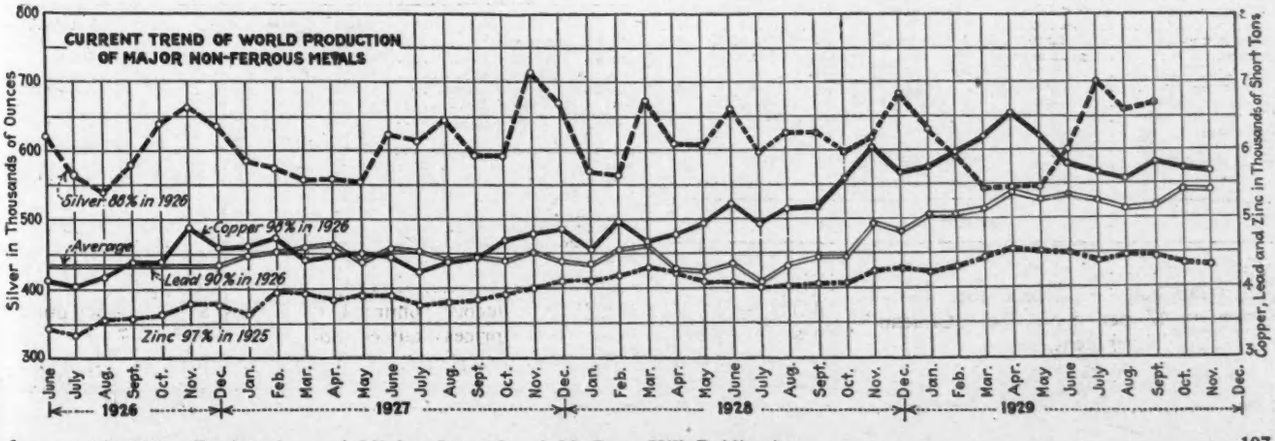








THE CURVES below are not to be considered as permanent records of production. They show merely the current trend in terms of daily output according to the latest estimates of the American Bureau of Metal Statistics. The figures represent production from countries that produce approximately 98 per cent of the world's copper, 97 per cent of the zinc, 90 per cent of the lead, and 88 per cent of the silver. The figures for lead on the new basis are not available for the individual months of 1926, and accordingly the horizontal line showing the monthly average reduced to a daily rate is shown. Delay in receipt of statistics from Mexico accounts for the failure of the silver curve to be up to date.


CURRENT TREND OF WORLD PRODUCTION
OF MAJOR NON-FERROUS METALS
Silver in Thousands of Ounces
Copper, Lead and Zinc in Thousands of Short Tons
Silver 88% in 1926
Copper 96% in 1926
Average
Lead 90% in 1926
Zinc 97% in 1925
June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
1926
1927
1928
1929

Mining Stocks—Two Weeks Ended January 11, 1930

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Anaconda Copper	New York	79¼	71	74⅛	Ja 11, Fe 17 Q 1.75
Andes Copper	New York	36¼	32½	35	Ja 11, Fe 10 Q 0.75
Arizona Commercial	Boston	1¼	1⅛	1⅛	Ja. 16, Ja. 31 0.25
Calumet & Arizona	New York	89¼	81½	88½	De. 6, De. 23 Q 2.50
Calumet & Hecla	New York	32½	28½	29½	No. 30, De. 31 Q 1.50
Cerro de Pasco	New York	65⅛	62⅛	62½	Ja. 16, Fe. 1 Q 1.50
Con. Coppermines	N. Y. Curb	6	5	5⅛	
Copper Range	Boston	16	14½	15	De. 14, Ja. 15 Q 0.50
East Butte	Boston	1⅞	1⅛	1⅛	No. 20, De. 21 0.25
Granby Cons	New York	59¼	49¼	55	Oc. 18, No. 1 Q 2.00
Greene Cananea	New York			112	De. 12, Ja. 6 Q 2.00
Howe Sound	New York	39⅛	36⅛	38	De.31,Ja.15 QX 1.50
Hudson Bay	N. Y. Curb	10⅛	8⅛	10⅛	
Inspiration	New York	30½	26	29½	De. 19, Ja. 6 Q 1.00
Isle Royale	Boston	12½	11⅛	12	No. 30, De. 31 Q 0.50
Kennecott	New York	62½	55⅛	59	No. 29, Ja. 2 Q 1.25
Magma Copper	New York	52⅛	46	50⅛	De. 30, Ja. 15 Q 1.25
Miami Copper	New York	31⅛	25⅛	29⅛	Fe. 1, Fe. 15 Q 1.00
Mohawk	Boston	43⅛	42	43	Ja. 31, Mr. 1 1.50
Mother Lode	New York	2	1⅛	1⅛	De. 9, De. 31 0.20
Nevada Cons	New York	32⅛	28	30	De. 13, De. 31 Q 0.75
Noranda	N. Y. Curb	37½	32⅛	35⅛	De. 10, Ja. 2 Q 0.75
Ohio Copper	N. Y. Curb	1⅛	1	1⅛	Sept. 1926 0.03
Old Dominion	Boston	6⅛	6⅛	6⅛	Dec. 1918 1.00
Phelps Dodge	New York	43⅛	38⅛	41⅛	De. 6, Ja. 2 Q 0.75
Quincy	Boston	19⅛	17	18⅛	March, 1920 1.00
Roan Antelope	N. Y. Curb	33	25⅛	31⅛	
St. Mary's M. L.	Boston	27⅛	24⅛	25⅛	No. 29, De. 10 1.00
Seneca Copper	New York	2⅛	2⅛	2⅛	
Shattuck Denn	N. Y. Curb	9⅛	8⅛	9⅛	
Sherritt-Gordon	Toronto	3.16	2.85	2.88	
Tenn. C. & C	New York	13⅞	12⅛	13⅛	No. 30, De. 16 Q 0.25
United Verde Ex	N. Y. Curb	13⅛	11⅛	12	Ja. 2, Fe. 1 Q 1.00
Utah Copper	New York	225	205	225	De.13,De.31 QX 8.00
Waite-Ack.-Mont	Toronto	3.40	3.20	3.25	
Walker Mining	Salt Lake	4.50	4.30	4.40	
Nevada Copper	N. Y. Curb	*87⅛	*56⅛	*87⅛	
LEAD, ZINC, SILVER					
Ahumada Lead	New York	*75	*37½	*62½	
Amer. Z., L. & S.	New York	12⅜	7⅜	11⅛	May, 1917 1.00
Amer. Z., L. & S. pfd.	New York	70	54	70	De. 12, Ja. 1 Q 1.50
Bunker Hill & S	N. Y. Curb	98⅛	70½	70½	De.25, Ja. MX 0.75
Butte Cop. & Z.	New York	3⅛	3	3⅛	De. 10, De. 25 0.50
Butte & Sup.	New York	5⅛	4⅛	4⅛	De. 13, De. 31 Q 0.50
Callahan Zn.-Ld.	New York	1½	1	1⅛	De. 1920 0.50
Chief. Cons.	Salt Lake	1.85	1.85	1.85	Fe. 1, 1918 K 0.10
Cons. Ld. & Zn. "A"	St. Louis	6	5	5⅛	Jan. 1930 Q 0.12½
Constitution	Spokane	*32	*26	*29	
Dayrock	Spokane	2.50	1.98	2.20	Je. 20, Je. 30 0.03
Dickens Consol	Spokane	3⅛	1⅞	2⅛	
Eagle-Picher	Cincinnati	13	12⅛	12⅛	De. 31, Ja. 15 Q 0.20
Eagle-Picher, pfd.	Cincinnati			101	De. 31, Ja. 15 Q 1.50
Eureka Lily	Salt Lake			36⅛	
Evans-Wallower	N Y. Curb	5⅛	4	4⅛	
Evans-Wal., pfd.	N. Y. Curb			80	De.20, Ja.1 Q 1.75
Federal M. & S.	New York	175	175	175	June, 1927 10.00
Fed. M. & S., pfd.	New York			96⅛	No. 25, De.16 Q 1.75
Golconda	Spokane	*87	*80	*84	Je. 15, Jl. 1 0.02
Grandview	Spokane	*17	*13¼	*14⅛	
Hecla Mining	N. Y. Curb	12⅛	11	12⅛	No. 15, De. 15 Q 0.25
Highland-Surprise	Spokane	*7⅛	*6	*7	
Jack Waite	Spokane	*9⅛	*6⅛	*8	
Kootenay Florence	Spokane	*7⅛	*6	*7	
Lucky Jim	Spokane	*6⅛	*6	*6	
Mexican Premier	Spokane	2.04	1.95	2.02	Ja. 15, Ja. 30 0.01
National Lead	New York			137	De. 13, De. 31 Q 1.25
Natl. Lead, pfd. A	New York	140	138⅛	139	Nv.29, De.14 Q 1.75
Natl. Lead, pfd. B	New York	117	116⅛	116⅛	Je. 17, Fe. 1 Q 1.50
N. J. Zinc, new	N. Y. Curb	71⅛	66⅛	71⅛	Ja.20, Fe. 10 Q 0.50
New Quincy	Salt Lake	1.22½	1.05	1.17½	Se. 20, Se. 30 Q 0.10
Noble Five	Spokane	*39	*32	*35	
North Lily	Spokane	*19	*15	*18	
Park Bingham	Salt Lake	6	5½	6	
Park City Con.	Salt Lake	*75	*60	*60	
Park Utah	New York	3⅛	3	3⅛	Dividends suspended
Pend Oreille	Spokane	3.00	2.40	2.80	
Rico Argentine	Salt Lake			*15½	No. 30, De. 15 Q 0.03
Ruth-Hope	Spokane	*19	*15	*18	
St. Joseph Lead	New York	51⅛	47⅛	50⅛	Mr.7, Mr. 20 QX 0.75
Sherman Lead	Spokane	82⅛	70	77	
Silver King Coa.	Salt Lake	10.37½	9.50	10.50	De.15, Ja.2 QX 0.45
Silversmith	Spokane	*6	*5½	*5½	Oct., 1926 0.02
Sunshine Mining	Spokane	4.60	3.00	3.65	De. 10, De. 20 Q 0.08
Tamarack-Custer	Spokane	*59	*52	*52	Sept., 1924 0.25
Tintic Standard	Salt Lake	10.50	10.12½	10.50	Se. 17, Se. 20 X 0.30
Tonopah Belmont	N. Y. Curb			*37½	Oct., 1925 0.05
Treadwell-Yukon	Toronto	7.00	6.00	6.00	
Utah Apex	Boston	3	2⅜	2⅜	Oc. 15, No. 1 0.25
Utah Met. & Tun.	Boston	*70	*60	*65	Dec., 1927 0.30
Whitewater	Spokane	*19	*17	*17	
GOLD					
Alaska Juneau	New York	9¼	7	8⅛	
Barry-Hollinger	Toronto	*17	*14	*15	
Central Manitoba	Toronto	*25	*20	*25	
Cresson Consol	N. Y. Curb	*43⅜	*25	*43⅜	De. 31, Ja. 27 Q 0.025
Dome Mines	New York	7⅜	6⅜	7⅛	Mr. 31, Ap. 21 Q 0.25
Golden Cycle	Col. Springs	†15.00	†14.38		No. 30, De. 10 0.40
Hollinger	Toronto	5.10	4.95	5.00	Ja.14,Ja.28 M 0.05
Homestake	New York			80	Ja.20, Ja.25 MX 1.50
Kirkland Lake	Toronto	*60	*43	*52	
Lake Shore	Toronto	20.00	19.00	19.25	De.2, De.16 Q 0.30
McIntyre Porcupine	New York	16½	14⅞	18⅛	Fe. 1, Mr. 1 Q 0.05
Portland	Col. Springs	†*5	†*00		April, 1927 0.01
Rand Mines	New York	37⅛	35⅛	37	Au.21, 29 A.s. 1.50
Siscoe	Toronto	*50	*41	*47	
Sylvanite	Toronto	*51	*40	*51	
Teck-Hughes	Toronto	5.15	4.85	5.00	Ja. 17, Fe. 1 Q 0.15
Tom Reed	Los Angeles	*52	*50	*51	Dec., 1926 0.02
Unity Gold	N. Y. Curb	*68⅛	*43⅛	*68⅛	
Vipond Consol	Toronto	*68	*63	*67	April, 1927 0.03
Wright-Hargreaves	Toronto	1.55	1.32	1.35	Oc. 16, No. 1 0.02½
Yukon-Alaska	N. Y. Curb			35⅛	
GOLD AND SILVER					
Carnegie Metals	N. Y. Curb	6	4⅛	6	
Castle-Trethewey	Toronto	*25	*20	*20	
Consol. Cortez	N. Y. Curb	*12⅛	*6⅛	*6⅛	
Dolores Esperanza	N. Y. Curb	*6⅛	*6⅛	*6⅛	July, 1923 0.05
Keeley	Toronto	*40	*31⅛	*40	Mr. 15, 1928 0.04
Mining Corp	Toronto	3.00	2.80	2.90	De. 4, De. 19 0.12½
Montana-Mines Corp.	Spokane	*46	*40	*41	
N. Y. & Hond. Ros.	N. Y. Curb	16	16	16	De.18, De.28 X 0.50
Nipissing	N. Y. Curb	1⅛	1⅛	1⅛	De. 31, Ja. 20 Q 0.07½
Premier Gold	N. Y. Curb	1⅛	1⅛	1⅛	De. 11, Ja. 4 Q 0.06
Tonopah Exten	N. Y. Curb			*10	April, 1925 0.05
Tonopah Mining	N. Y. Curb	2	2	2	Se. 30, Oc. 21 0.07½
United Eastern	N. Y. Curb			*18⅛	
Yukon Gold	N. Y. Curb			*56⅛	June, 1918 0.02
IRON AND STEEL					
Bethlehem Steel	New York	97⅛	91⅛	96⅛	Jan. 18, Fe. 15 Q 1.50
Beth. Steel, pfd, 7%...	New York	123½	122⅛	122⅛	De. 7, Ja. 2 Q 1.75
Cleveland-Cliffs, pfd.	Cleveland	93⅛	92	93	De.10, De.20 Q 1.00
Colo. Fuel & Iron	New York	43⅛	34⅛	41⅛	
Great Northern Iron	New York	21⅛	19⅛	21⅛	Dec. 15 K 2.00
Inland Steel	New York	74	70⅛	74	No. 15, De. 1 Q 0.87½
Republic I. & S.	New York	79⅞	71	77⅛	No. 12, De. 2 Q 1.00
Republic I. & S. pfd.	New York	109½	107	109½	De. 12, Ja. 2 Q 1.75
Sloss-Sheffield S. & I.	New York	40	35	40	Mr. 11, Mr. 20 Q 1.50
Sloss-Sheff. S.&I., pfd.	New York			73½	De. 20, Ja. 2 Q 1.75
U. S. Steel	New York	173½	164⅛	169⅛	No.30, De.30 QX 2.75
U. S. Steel, pfd.	New York	142	141	142	No. 2, No. 29 Q 1.75
MISCELLANEOUS					
Aluminum Co. of Am.	N. Y. Curb	299	287	290	
Alum. Co. of Amer., pf.	N. Y. Curb	108½	107⅛	108	De. 14, Ja. 1 Q 1.50
American Metal	New York	48⅛	43	47⅛	No. 20, De.2 Q 0.75
Amer. Metal, pfd., 6%	New York			113	No. 20, De.2 Q 1.50
Amer. Sm. & Ref.	New York	76	70⅛	73⅛	Ja. 17, Fe. 1 Q 1.00
Amer. Sm. & Ref., pfd.	New York	137	134⅛	136	Ja 31, Mr. 1 Q 1.75
Ang. Ch. Nitrate	N. Y. Curb	21⅛	17⅛	21⅛	
Asbestos Corp.	Montreal	2⅛	2⅛	2⅛	Jan., 1926 1.50
Asbestos Corp., pfd.	Montreal	11	10	10	De. 31, Ja. 15 Q 1.75
Consol. M. & S.	Montreal	265	250	265	De. 31, Ja. 15 X 6.25
Federated Metals	N. Y. Curb	23⅛	23⅛	23⅛	De.20,De. 30 QX 0.50
Freeport Texas	New York	43⅛	37⅛	42⅛	Oc. 15, No. 1 Q 1.00
Int. Nickel Can.	New York	36⅛	30⅛	35⅛	No. 30, De. 31 Q 0.25
Int. Nickel, pfd.	New York	118	118	118	De. 28,. Fe 1 Q 1.75
Mayflower Assoc.	N. Y. Curb	51	47⅛	50⅛	
Newmont	N. Y. Curb	119⅛	100	113	De. 27, Ja. 15 Q 1.00
Patino M. & E.	New York	30	28	29⅛	De. 7, De. 24 4s.
So. America G. & P.	N. Y. Curb	1⅛	1⅛	1⅛	
Texas Gulf Sulphur	New York	59	52⅛	58	De. 2, De. 16 Q 1.00
U. S. Sm. R. & M.	New York	36⅛	34⅛	34⅛	De. 31, Ja. 5 Q 0.87½
U. S. Sm. R. & M., pfd	New York	53⅛	52	53⅛	De. 31, Ja. 5 Q 0.87½
Vanadium Corp.	New York	54⅛	46⅛	53	Nv.1, Dc.16 QX 1.75

Toronto Standard Stock Exchange, Toronto, courtesy the Arthur E. Moysey Co.; Salt Lake Stock Exchange, courtesy J. A. Hogle & Co. and Logan & Bryan, New York; Standard Stock Exchange, Spokane, courtesy Pohlman Investment Company

*Cents per share. †Bid—asked range. Q, Quarterly. A. Annually. SA, Semi-annually. M, Monthly. BM, Bimonthly. FW, Four weeks. K, Irregular. I Initial. R, Resumption. X, Extra. The first date given is that of the closing of the books; the second that of the payment of the dividend. A.s., American shares.

LONDON QUOTATIONS—ONE WEEK ENDED DECEMBER 31, 1929

	High	Low	Last	Date	Amount
Alaska Mexican ($5)	12/6	12/6	12/6		
Alaska Treadwell ($25)	60/—	60/—	60/—	Nov., 1926	4 p.c.
Aramayo Mines (25 frs.)	42/6	38/1½	40/—	Nov., 1929	5 p.c.
Burma Corpn. (10 rupees)	16/9½	15/—	15/1½	Feb., 1930	7 annas*
Bwana M'Kubwa (5s)	21/6	20/1½	21/3		
Camp Bird (2s)	1/6	1/—	1/3	April, 1928	16⅔ p.c.
El Oro (5s)	2/6	2/2	2/6	Nov., 1929	20⅚ p.c.
Frontino & Bolivia (£1)	7/9	7/9	7/9	Jan., 1929	3⅓ p.c.
Mexican Corpn. (£1)	11/4½	10/—	10/6	Oct., 1929	10 p.c.
Mexico Mines of El Oro (£1)	2/6	1/10½	2/6	Dec., 1926	3⅓ p.c.*
Mount Isa (£1)	26/3	24/3	25/—		
N'Changa Copper Mining (£1)	37/—	35/—	36/3		
Oroville Dredging (4s)	1/3	1/3	1/3	Nov., 1928	31½ p.c.
Rhodesian Congo Border (£1)	143/9	132/6	142/6		
St. John del Rey (£1)	17/3	16/7½	16/9	Dec., 1929	2½ p.c.
San Francisco Mines (10s)	27/7½	25/9	26/3	June, 1929	15 p.c.
Santa Gertrudis (£1)	12/3	9/9	10/6	Jan., 1930	7½ p.c.
Selukwe (2s. 6d.)	4/3	4/—	4/3	April, 1917	6¼ p.c.
S. Amer. Copper (2s)	1/7½	1/7½	1/7½	Nov., 1917	75 p.c.
Tanganyika (£1)	39/4½	35/7½	39/4½	July, 1929	7½ p.c.
Union Miniere du Haut-Katanga (Brussels)	8,550	8,430	8,535	April, 1929	300 fr. (‡)

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian francs and free of taxation.